FOUNDRY TRADE JOURNAL

EST. 1902

WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

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Offices: John Adam House, John Adam St., London, W.C.2

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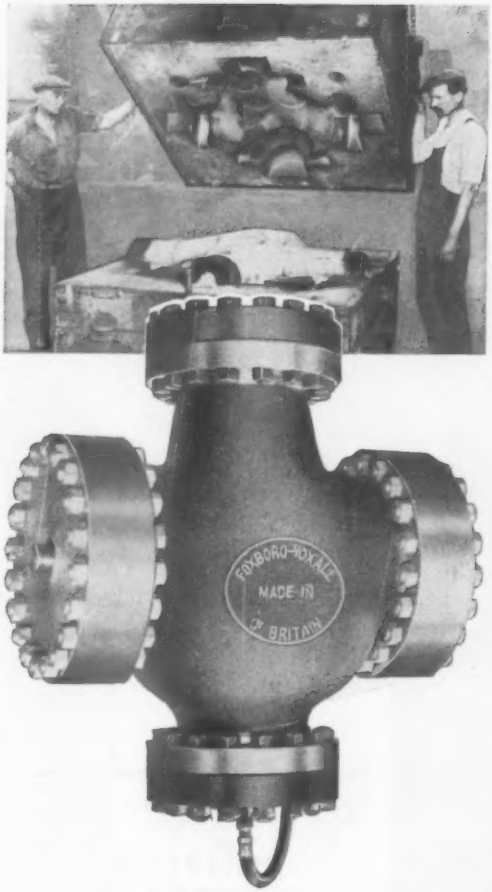
Spermolin CORE OILS AND BINDERS

For every type of casting



Carbon steel valve casting, weight 3 tons, tested under pressure at 2,000 lbs per sq. in., for oil-installation. Photo of core and casting by courtesy of Messrs Lake & Elliot, Ltd., Iron and Steel Founders, Braintree, Essex.

★ CORE OILS
★ COLD SETTING OILS
★ CORE CREAMS
★ SEMI-SOLIDS
★ CO_2 BINDERS
★ CEREAL BINDERS
★ MIXING & CORE MACHINES

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Single Lever Operation
Higher Production

The New Single Lever Redford No. 1A still retains its STRENGTH and SIMPLICITY, but reduces operational time, maintenance costs and labour fatigue. With FOUR operations in ONE production is even higher.

If you make cores up to 2 lbs. you should use a Redford. It will make them quicker and cheaper than any comparable machine on the world market today.

It has great adaptiveness and is used widely co-operating the CO_2 process and the design provides rapid action to all adjustable parts, including the pneumatic clamps.

To BRITISH RONCERAY LIMITED

Please send me further details of the Redford Core Blower/Redford Pneumatic Clamp without obligation.

Name .....

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Just attach to one of your letter-headings and post to-day to:—

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Foundry Suppliers
25A, Cockspur Street,
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Routine checking of moulding and core sand properties is essential and guarantees improved surface finish of castings, fewer rejects and economical use of sands. The production of quality castings begins with sand testing. In many countries of the world preference is given to

Sand Testing Equipment.

Easy handling - reliable test results - pleasing appearance.

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THIS CRESCENZI FURNACE may be just what you need

It is a Mains Frequency Electric Induction Furnace of the Coreless "CSA" Type for the production of special iron and steel, reclamation of C.I. borings and recarbonisation of steel scrap. With this furnace temperatures up to 1600°C. can be obtained and continuous or intermittent operation is permissible.

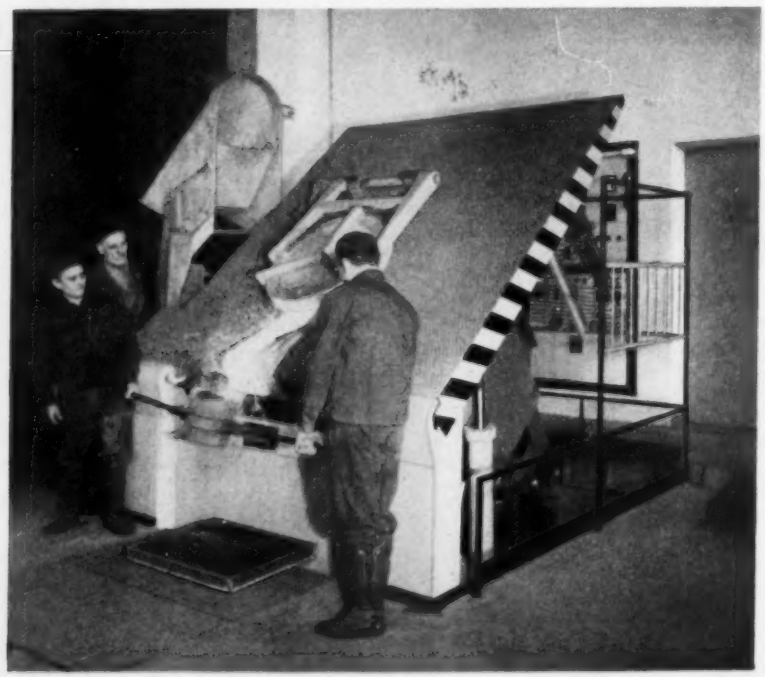
if it is

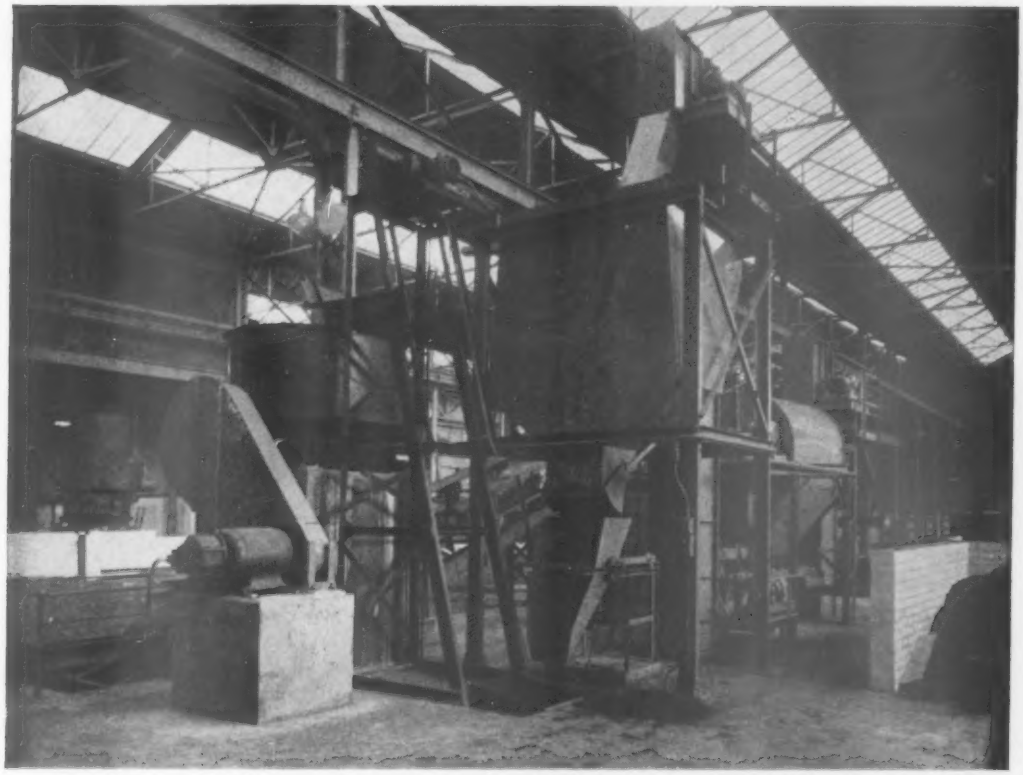
GET IN TOUCH WITH **Roper**

E. A. ROPER & CO. LTD. FOUNDRY EQUIPMENT ENGINEERS, KEIGHLEY, YORKSHIRE

Tel : Keighley 4215/6 *Grams : "Climax," Keighley*

The illustration shows a Coreless Furnace (Reference "CSA") of 1½ tons capacity, with a rating of 300 KVA.





This Pneulec plant provides all facilities from knockout through sand cleaning and mixing to delivery over moulding units. We build similar plants in all capacities.

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PNEULEC LIMITED, SMETHWICK, Nr. BIRMINGHAM

PORTABLE TYPE

Sandslinger

- Speeds up ramming and reduces costs
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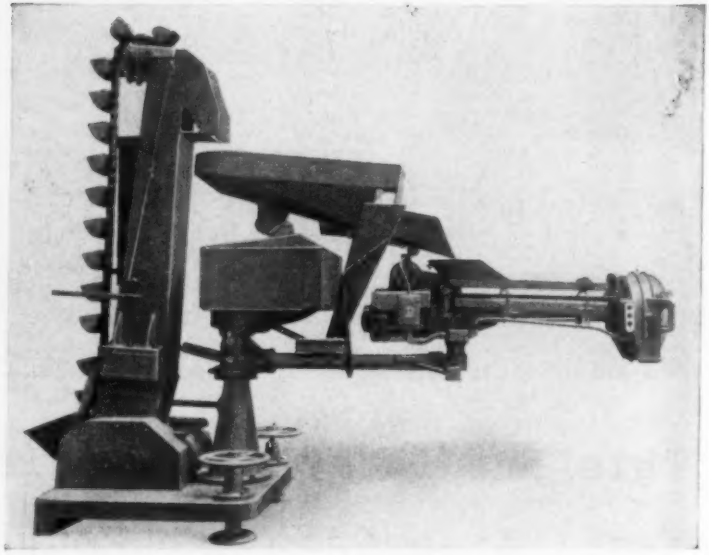
- No foundations or air supply required, a flexible electric connection sets the machine to work
- TOTAL radius of arms 10 ft. Maximum height 12 ft.



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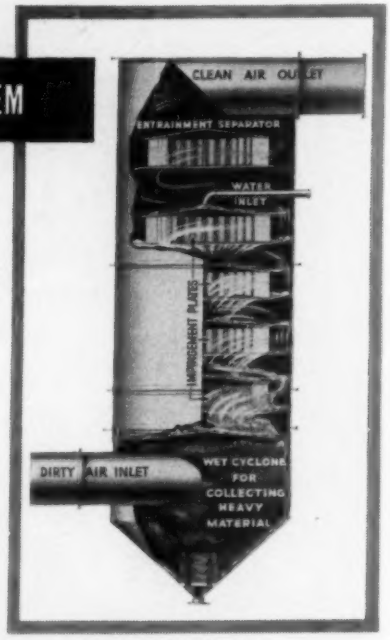
F53A

HOLMES-SCHNEIBLE MULTI-WASH SYSTEM

for Dust Collection and Control

The Holmes-Schneible Multi-Wash System has been specifically designed to tackle dust and fume problems in foundries. This system, which is fully comprehensive and covers every phase of dust collection and control, comprises exhaust hoods, ducting, collectors, fans and de-watering equipment.



A Holmes-Schneible Multi-Wash Collector, Type "IC".

A cut-away view of an HI Type Holmes-Connersville Positive Air Blower.

HOLMES-CONNERSVILLE POSITIVE DISPLACEMENT BLOWERS

for Foundry Cupolas and Convertors.

Holmes-Connersville Positive Air Blowers have been designed to give continuous trouble-free service and are consequently of extremely sturdy construction. With a positive displacement blower of this type a constant volume of air, irrespective of pressure conditions, is assured.

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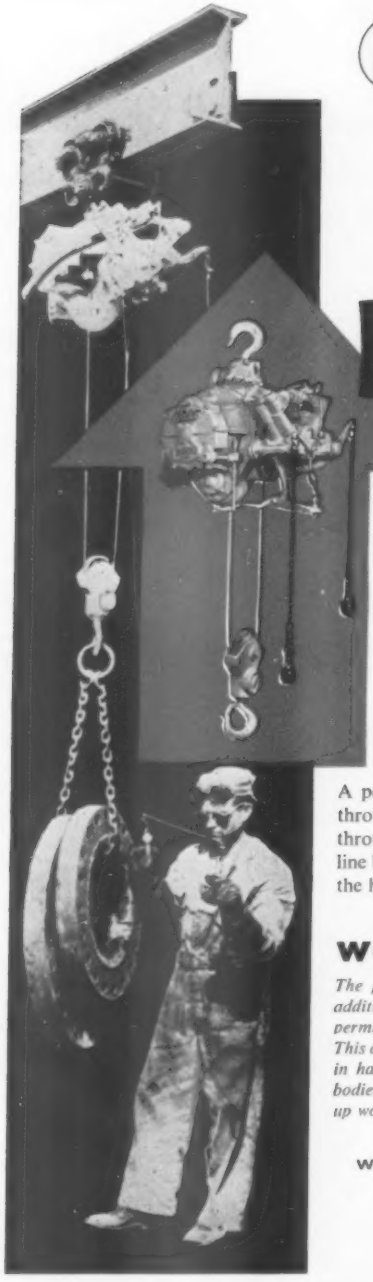


Safety

AIR MOTOR-DRIVEN

HOISTS

Thor Tools Ltd. Air Motor-Driven Hoists provide a SAFE and RELIABLE solution to your Materials handling problems. The Motor is rigidly secured to the heavy steel cast Central Frame which takes the entire load strain. Starting, stopping, reversing and speed regulating are controlled by the Control Chains. The hoist operates smoothly and without the usual jerk found in throttle operated air hoists.

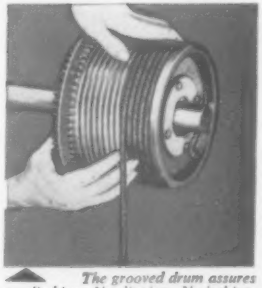
POSITIVE AIR BRAKE

A positive air brake which releases when the throttle opens is automatically applied as the throttle closes. The load cannot fall if the air line breaks or the compressor shuts down while the hoist is in operation.

EQUIPPED WITH WORM GEAR DRIVE

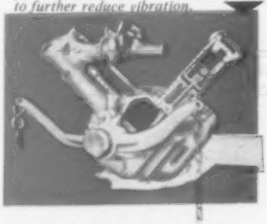
The positive worm, driving in both directions, in addition to the shifting eccentric used in the motor, permits the location of the load in any exact position. This ability to locate the load is absolutely necessary in handling foundry flasks, setting up automobile bodies in position on the assembly track, or setting up work for machine operations.

R57



The grooved drum assures no climbing. No slipping. No jerking. No frayed and dangerous cable. The cable ends are widely separated when the cable is down, thus preventing the load from twisting and winding up.

The motor: Famous Thor Tools Ltd. Close-Quarter type Motor with non-leakable seat throttle. Double-acting pistons cushioned at both ends of stroke to further reduce vibration.



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A3

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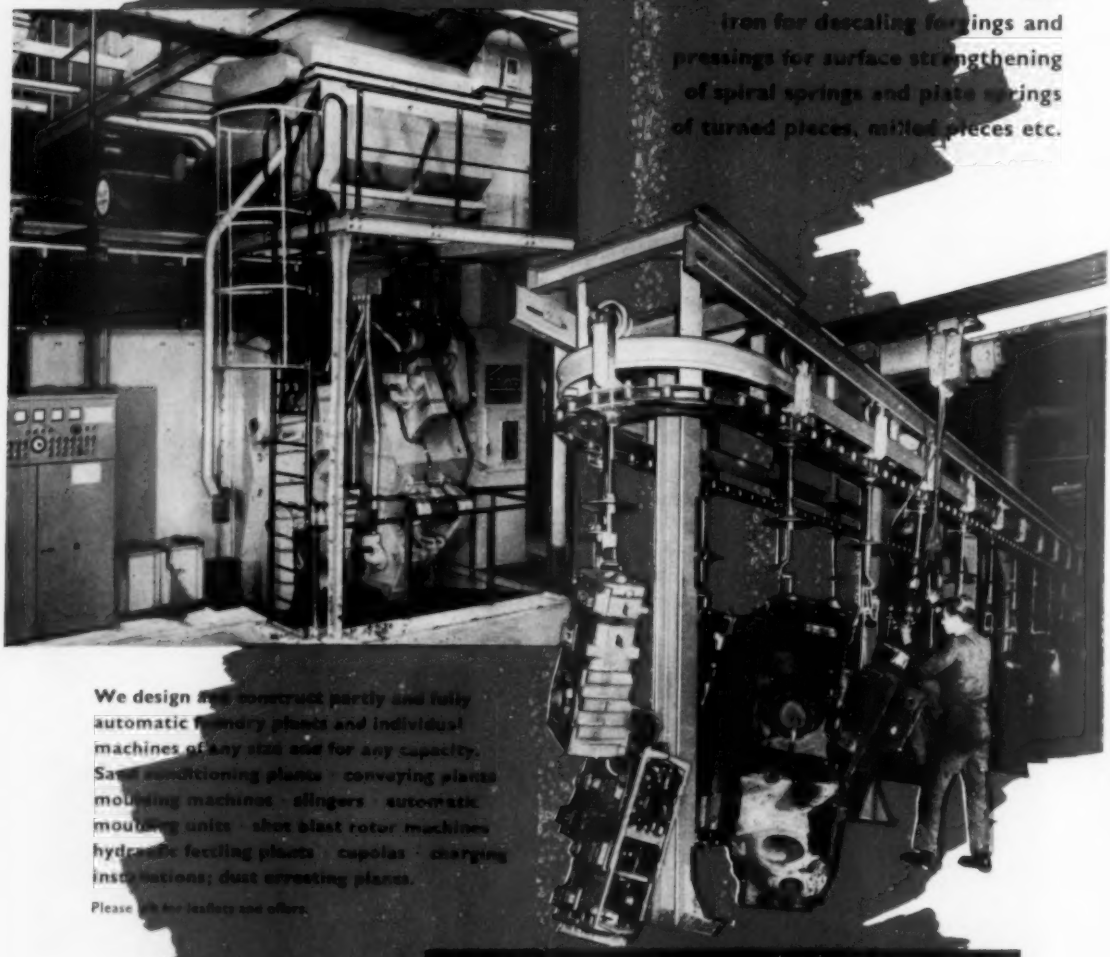
High Duty Machines

with rotary chain conveyor,

for cleaning and descaling cast steel, grey cast iron and malleable cast iron for descaling forgings and pressings for surface strengthening of spiral springs and plate springs of turned pieces, milled pieces etc.



We design and construct partly and fully automatic foundry plants and individual machines of any size and for any capacity. Sand conditioning plants · conveying plants moulding machines · slingers · automatic moulding units · shot blast rotor machines hydraulic fettling plants · cupolas · charging installations; dust arresting plants.

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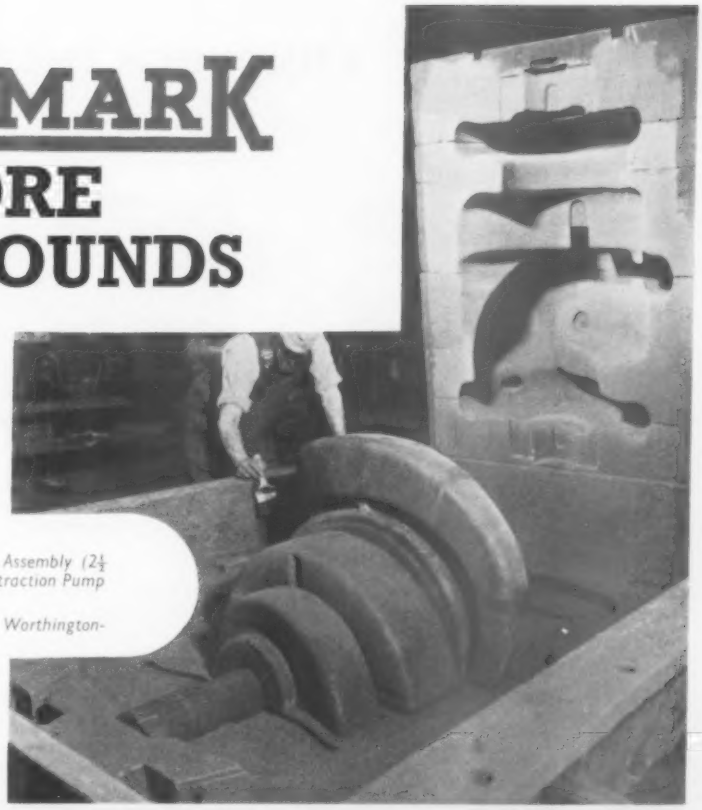
Representative for India: The Bombay Co. (Private) Ltd., P.O. Box 1081, Bombay 1, India.

HARMARK CORE COMPOUNDS

HARMARK SS/H is the Core Compound chosen by Messrs. Worthington-Simpson Ltd., Newark, Notts. for the whole of their pump core production.



A partially completed Core Assembly (2½ tons weight) for a 3-stage Extraction Pump Casing.

Illustrations by courtesy of Worthington-Simpson Ltd.

In work of high standard and intricacy, chances of core collapse cannot be taken lightly; this is perhaps the reason for the adoption by this famous firm of HARMARK SS/H Core Compound 10 years ago, and of its continued use since.

HARMARK FOUNDRY SUPPLIES

HARBOROUGH CONSTRUCTION CO·LTD·MARKET HARBOROUGH

FORDATH

ANNOUNCE THE NEW VERSATILE

Fur

FURANE BINDER

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VERSATILE—because the truly astonishing characteristics of this new Fordath chemical binder can be applied to all these coremaking techniques:—

HOT-BOX TECHNIQUE

FURSATIL at 2½% with HB CATALYST is used for the 5 second curing of blown cores: electrically heated core boxes yield cores ready for casting as fast as they can be stripped.

COLD-SETTING TECHNIQUE

FURSATIL at 2% with CS CATALYST gives a free-flowing chemically hardening sand with controlled setting times for heavy and complex cores and moulds.

CONVENTIONAL STOVING

FURSATIL at less than 1% alone, with or without cereal binders for desired green-bond, can be used for general core production with normal stoving conditions; very low baking cycle times are obtainable by catalyst additions.

WHAT IS FURSATIL?

It is a furfurylated amine-aldehyde condensation product, formulated and manufactured solely by Fordath in their West Bromwich plant.

WHAT ABOUT KNOCK-OUT?

Breakdown at casting temperatures is good resulting in excellent skin finish on casting in grey-iron and non-ferrous metals.

WHAT IS THE COST?

Briefly, FURSATIL bonded sands cost about ¼ the cost of the equivalent resin-coated sand and are prepared in normal sand mixing equipment. A total binder cost of 80/- per ton of prepared sand is an average figure.

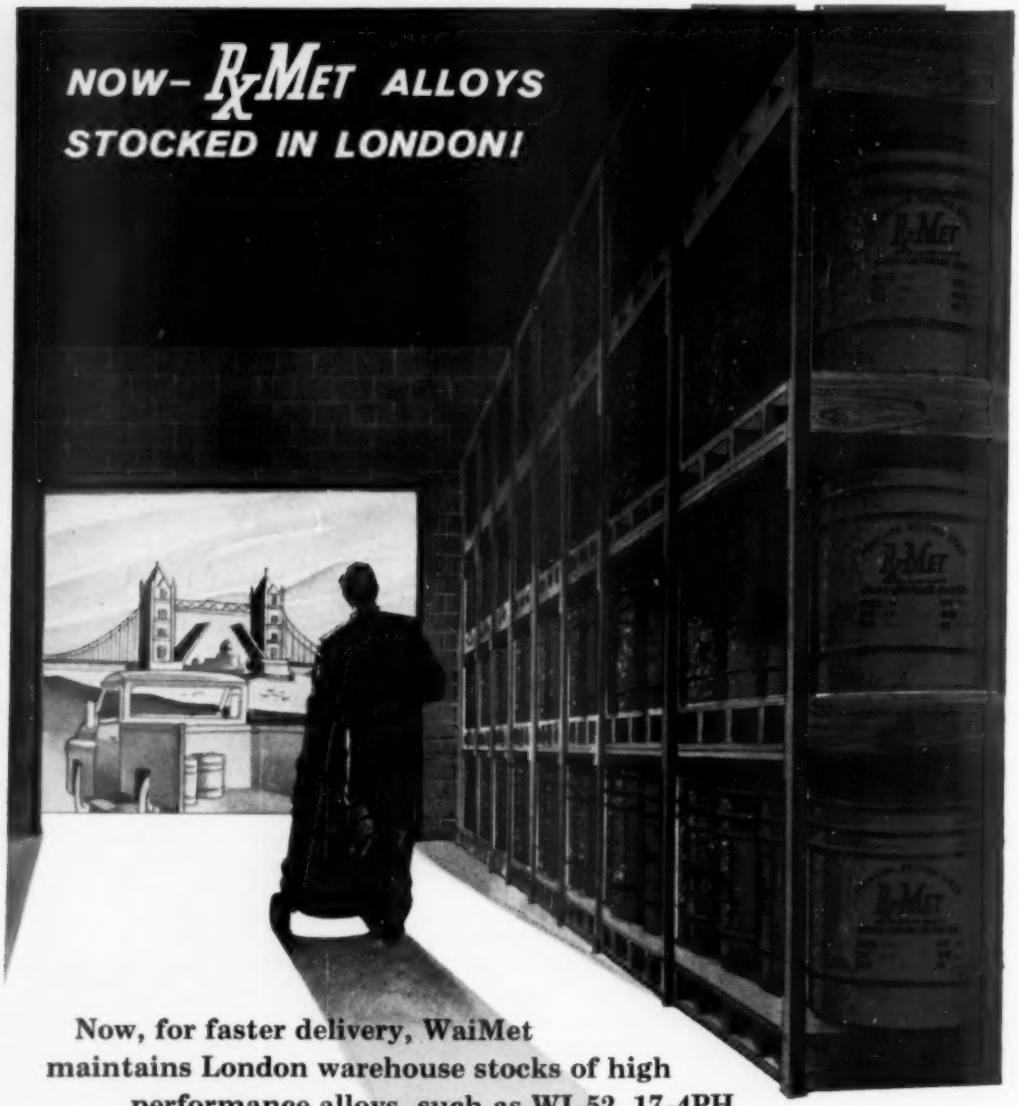
★ FURSATIL is a proprietary trade name of The Fordath Engineering Company Limited

Write for advance technical bulletin to:—

THE FORDATH ENGINEERING COMPANY LTD

BRANDON WAY, WEST BROMWICH, STAFFS, ENGLAND

Telephone: West Bromwich 1665 (4 Lines) Telegrams: Fordath Telex West Bromwich. Telex No: 33415



Now, for faster delivery, WaiMet maintains London warehouse stocks of high performance alloys, such as WI-52, 17-4PH, and SUPER 3. Contact us for fast, reliable service on RxMET® Certified Alloys.

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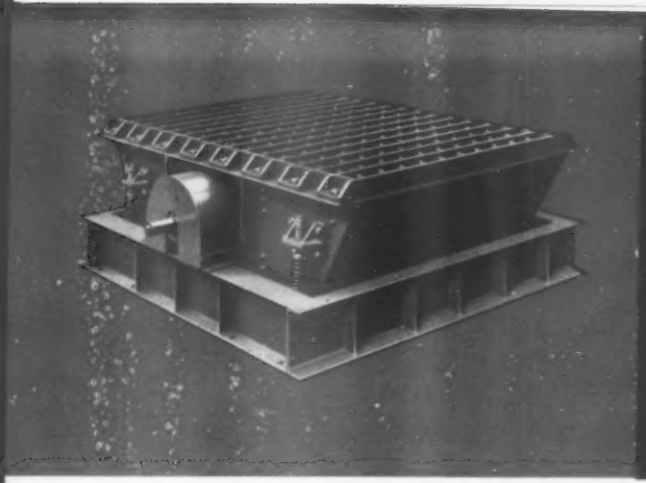


Sterling

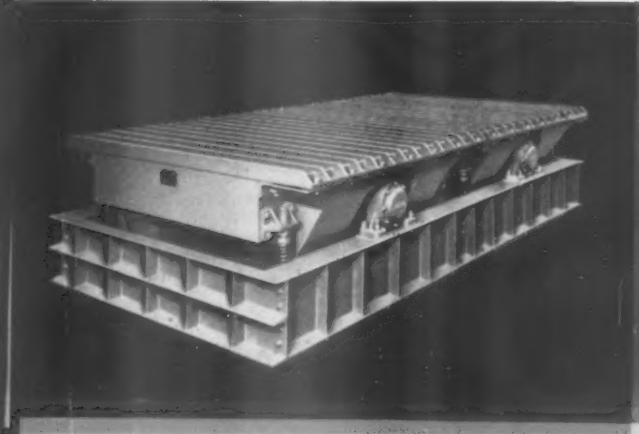
SHAKEOUT MACHINES

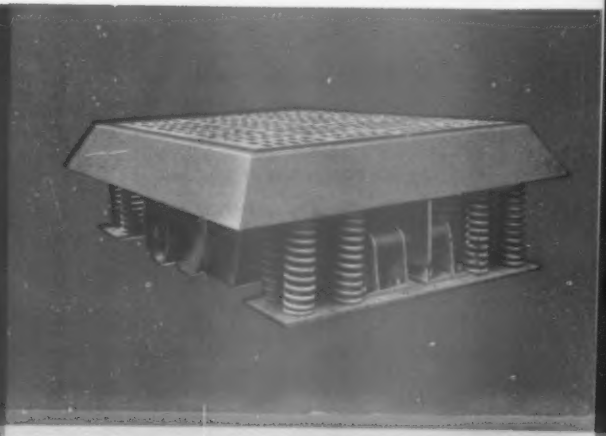
Sterling Shakeouts have been on the market for over 20 years and have been constantly improved during that period as a result of running experience in every type of foundry both at home and overseas.

They are made in capacities ranging from 2 cwts. per machine to 25 tons per machine. Multiple units can be supplied to take loads up to 150 tons.

You, like hundreds of other satisfied users, can rely on Sterling machines for speed of shakeout, reliability, and long life.

STERLING FOUNDRY SPECIALTIES LTD., LONDON ROAD, BEDFORD, ENGLAND

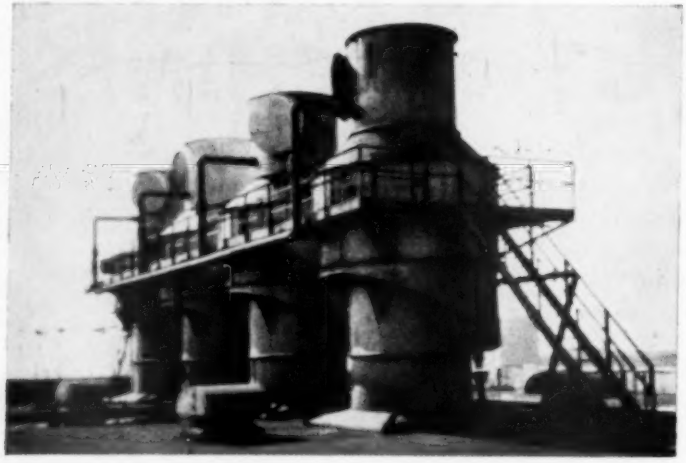




The 'CLEAN AIR ACT' demands EFFICIENT dust and grit suppression

Instal... TITAN WET ARRESTERS

Designed by the principal Cupola manufacturers in the U.K. with more than 40 years experience and proven practice in all aspects of Cupola operation.



Many Foundrymen think Wet Spark Arresters are a recent development and because of troubles experienced with some installations, usually caused through bad design, they tend to regard them with suspicion.

We are proud that FORD MOTOR CO. selected **TITAN** Wet Spark Arresters for the **4 TITAN** 30 ton per hour Hot Blast Cupolas which we installed in their new Thames Foundry, the most modern in Europe.

These are illustrated, the second Cupola from the left is "blowing" —note the complete absence of dark smoke, sure proof of efficiency.

Photo completely untouched taken during normal operating conditions.

CONSIDER THESE ADVANTAGES

- **Reduce Maintenance or Replacement of Gutters, Drains and Roof Sheeting**
- **Protection of Paintwork, Roof Structures and Coatings, Glazing, etc.**
- **Eliminate Fire Hazards. It's worth approaching your Insurance Company!**
- **Improve Working Conditions in Adjacent Workshops Enamelling Plants, Offices.**

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DESIGNERS & ACTUAL BUILDERS OF EFFICIENT FOUNDRY PLANT

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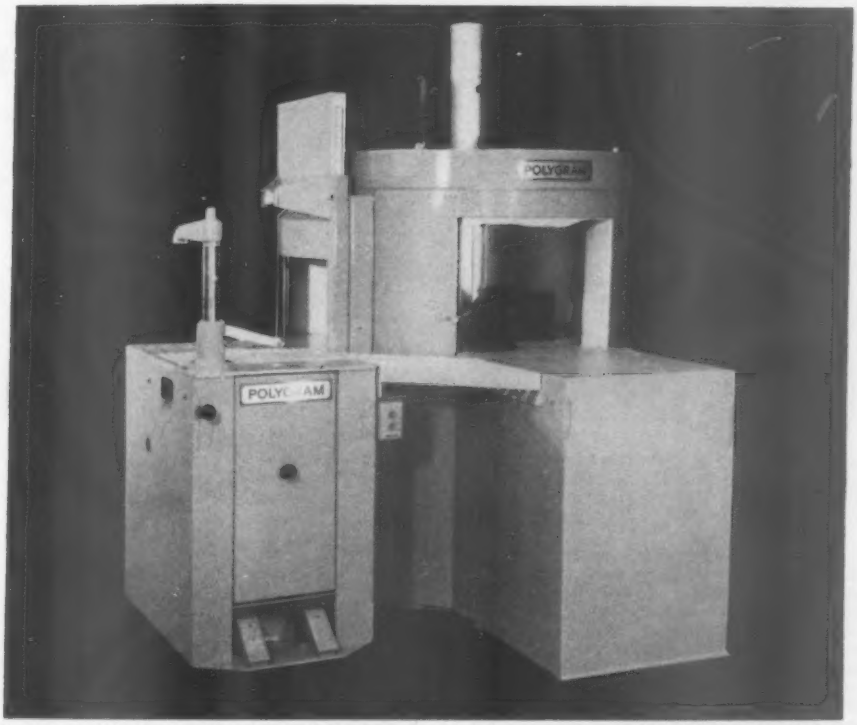
Send for brochure No. 213 TO-DAY

Announcing the 8*

POLYGRAM CMU Shell Coremaker for jobbing foundries



Designed to bring all the economic and technical advantages of shell cores into *your* foundry, the latest Polygram CMU Shell Coremaker is the fruit of 12-years of continuous research by the only British Specialists in Shell Moulding and Coremaking. Note that the unit construction enables you to fit a CMU core blower or oven into your existing layout and to expand it into a full CMU Shell Coremaker at *your* convenience.

8* *Features of the Polygram CMU Shell Coremaker*

- Maximum Versatility
- Maximum Complexity-of-Core
- Minimum Handling
- Minimum Maintenance
- Maximum Quality
- Maximum Production
- Minimum Skill
- Minimum Heat

Designed by Foundrymen—Built by Engineers

Write **NOW** for details to:

Polygram Casting Company Limited

THE FIRST NAME IN SHELL MOULDING

SHERNFOLD PARK · FRANT · TUNBRIDGE WELLS · ENGLAND. *Telephone:* Frant 346.

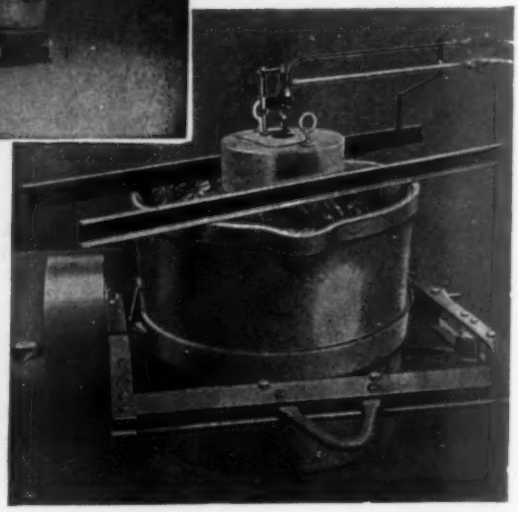
Serving the foundrymen of tomorrow—today

Ladle drying and preheating . . .

"NEWSTAD"

Gas or oil fired LADLE DRYERS

NEWSTAD Ladle Dryers provide the answers to a difficult foundry problem, speed and efficiency with economy



The Illustration above shows a Gas Fired Installation at the works of Messrs. Sterling Metals, Ltd., Coventry, used for Drying and Preheating Bogey Ladles.

Our oil fired Dryers are also available in sizes to suit all types of ladle from 5 cwt. capacity upwards. Control valves are remote from the burner making control easy and comfortable. As with the gas fired ladle dryer the degree of air and fuel turn down enables one size of dryer to dry several sizes of ladle. A safe and reliable means of drying and pre-heating ladles without smoke fumes or ash.

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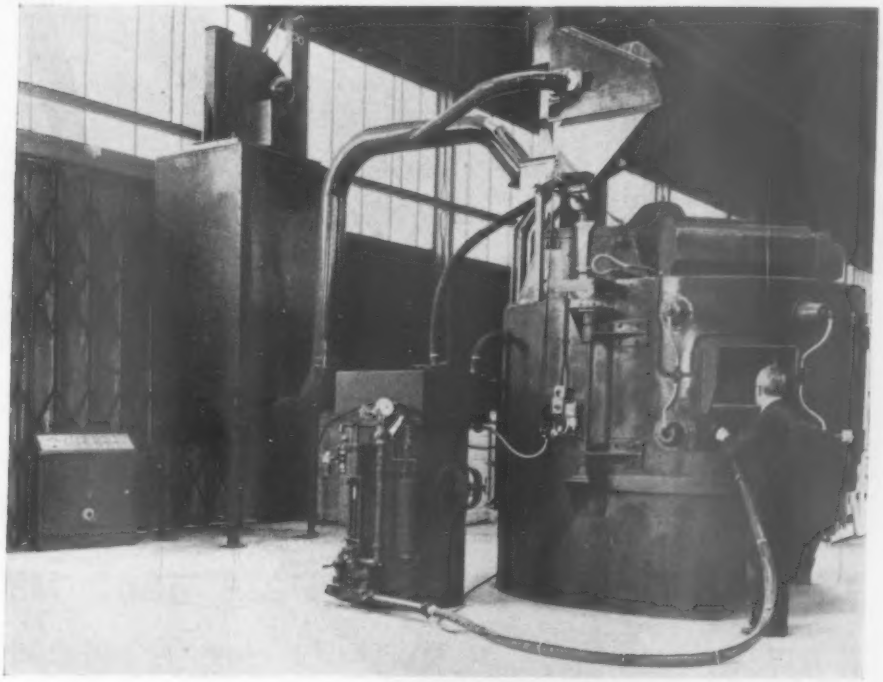

6' 0" dia. 'LK' Table Shot Blast Machine complete with Touch-up Unit together with Dust Collector.

Panqborn

SHOT BLAST & DUST CONTROL EQUIPMENT

ALSO

VIBRATORY FINISHING MACHINES

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"CONVEYOR"

Tel Nos
3695, 6 & 7

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As many foundrymen using the high quality Pig Iron we produce will readily agree. If you require greater density and toughness in your castings, with fewer rejects, cracks, or breaks, etc., then specify Refined Cold Blast Pig Iron from West Midland—we also specialise in Nickel and Chrome Alloys.

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FOR HIGH DUTY CASTINGS

CHILLED IRONS
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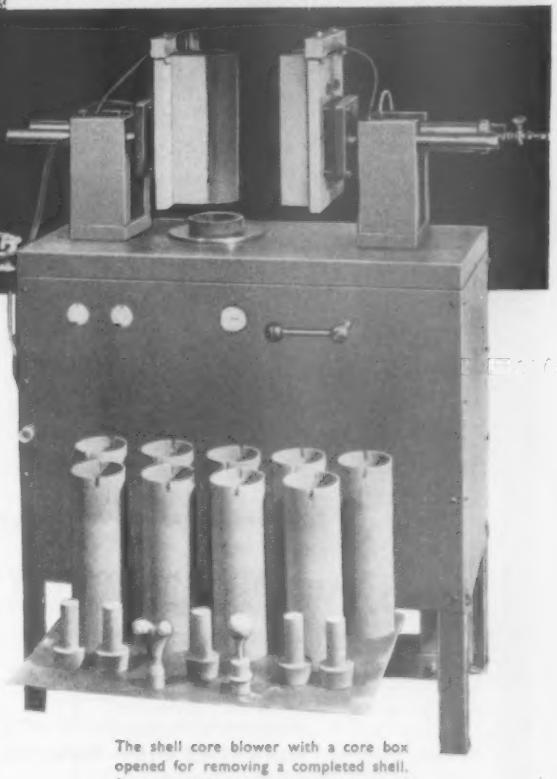
FAME



REYNOLDS

SHELL CORE BLOWER

The Reynolds Shell Core Blower, used with pre-coated resin sands, speeds production of high quality cores and reduces costs. The shells have only a fraction of the weight of solid cores and the saving in material and the elimination of mixing operations, more than offset the higher cost of resin bonded sands. Stronger cores are produced, special vents, supporting wires and driers are not required and the cores are ready for use immediately without further stoving. Storage life is considerably prolonged.

The shell core blower with a core box opened for removing a completed shell. Energy regulators, pressure gauge and control lever are mounted on the front panel. Some specimen cores are shown in front of the machine.

The core blower is of clean modern design, robustly constructed and suitable for use by unskilled operators.

FAME

FOUNDRY & METALLURGICAL EQUIPMENT CO. LTD.

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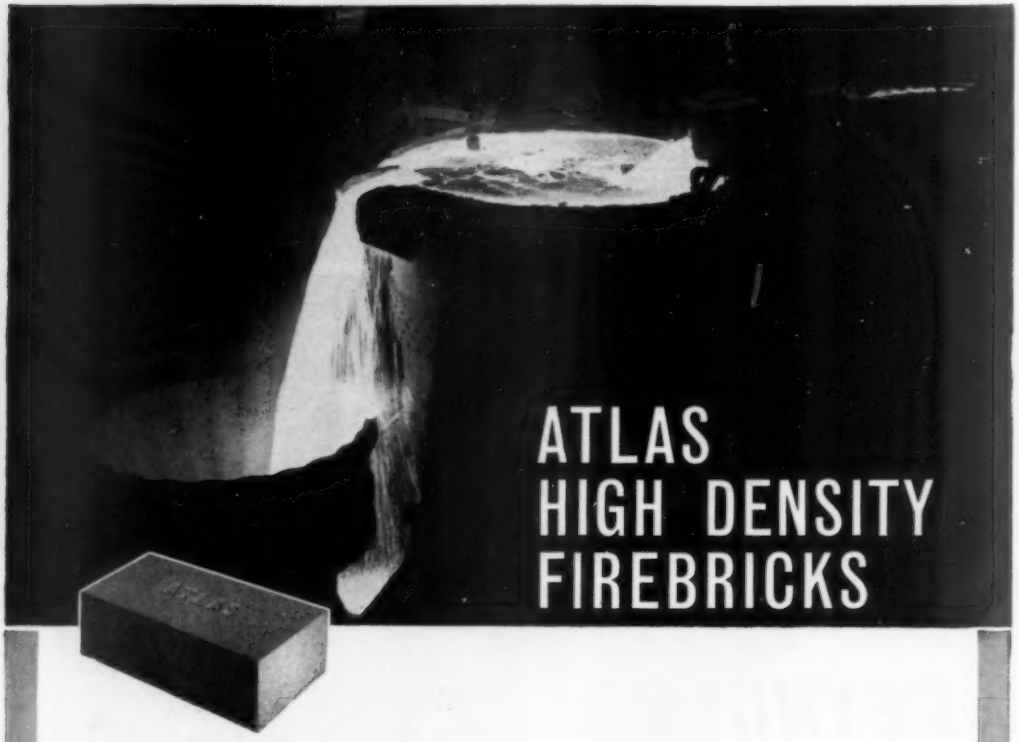

No firebrick can withstand high temperatures and heavy loads indefinitely.

But **ATLAS HIGH DENSITY** Firebricks have the maximum life possible under such conditions. They have been produced specifically for ladle linings and are quite unique in their performance in bottoms and the striking areas. High crushing strength and great resistance to penetration, erosion and abrasion have been combined to ensure a long working life.

Use **ATLAS HIGH DENSITY** Firebricks and line less often.

ILLUSTRATION

Tapping a furnace at Abbey Melting Shop, Steel Company of Wales Ltd. Ladle Bottoms are ATLAS Firebricks.

UNITED FIRECLAY PRODUCTS LTD

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Telephone: ARMADALE 313-316 Telegrams: "Combined" Armadale

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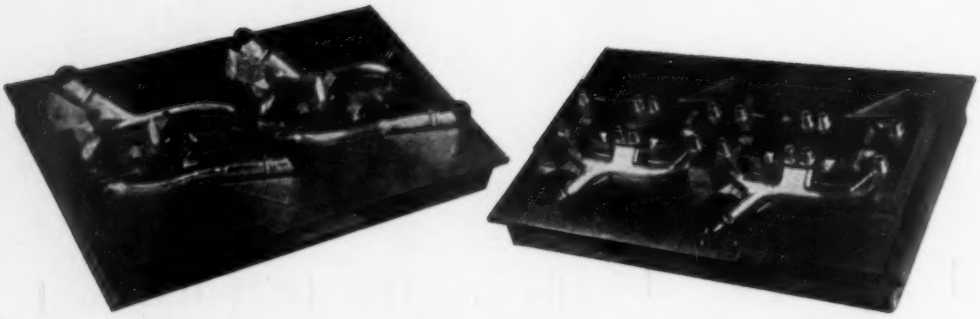

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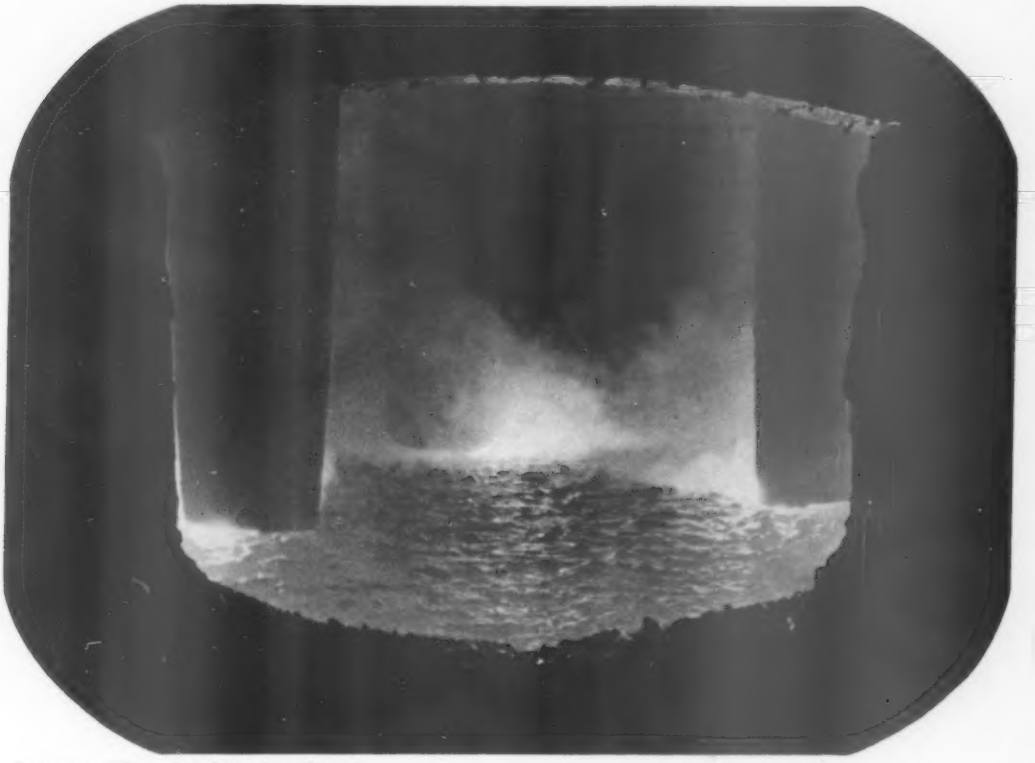

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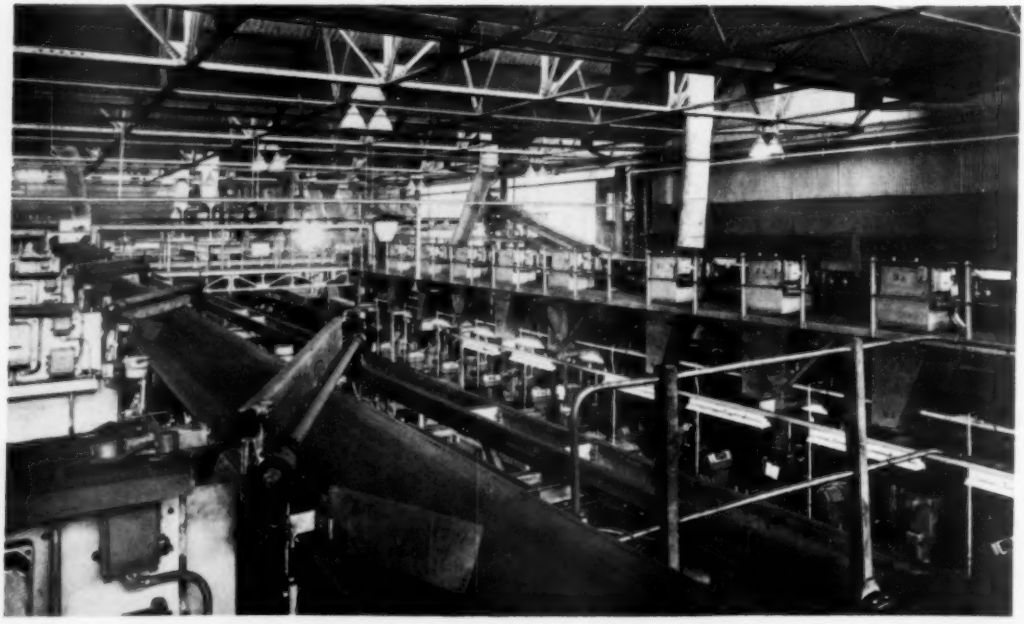

ILLUSTRATION ABOVE SHOWS VIEW OF SANDHANDLING AND DISTRIBUTION PLANT WITH TWIN OVERHEAD CONVEYORS FITTED WITH 16 *AUTOMATIC AND ELECTRONIC PLOUGHS*—ELIMINATING "*THE MAN OVERHEAD.*" *(PHOTOGRAPH BY COURTESY OF LEY'S MALLEABLE CASTINGS CO. LTD., DERBY.)*

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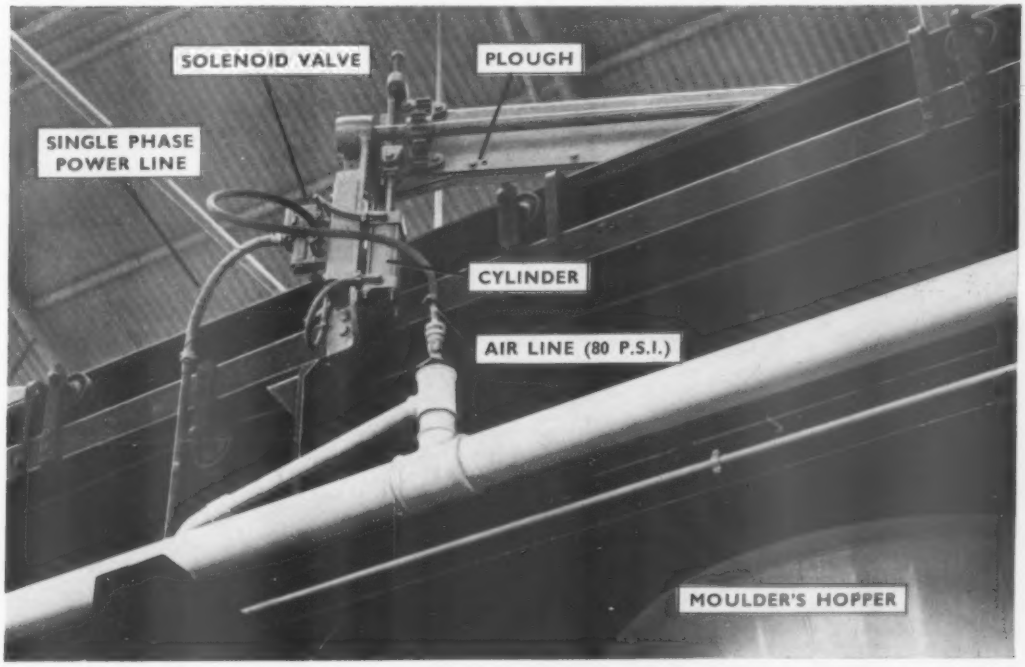

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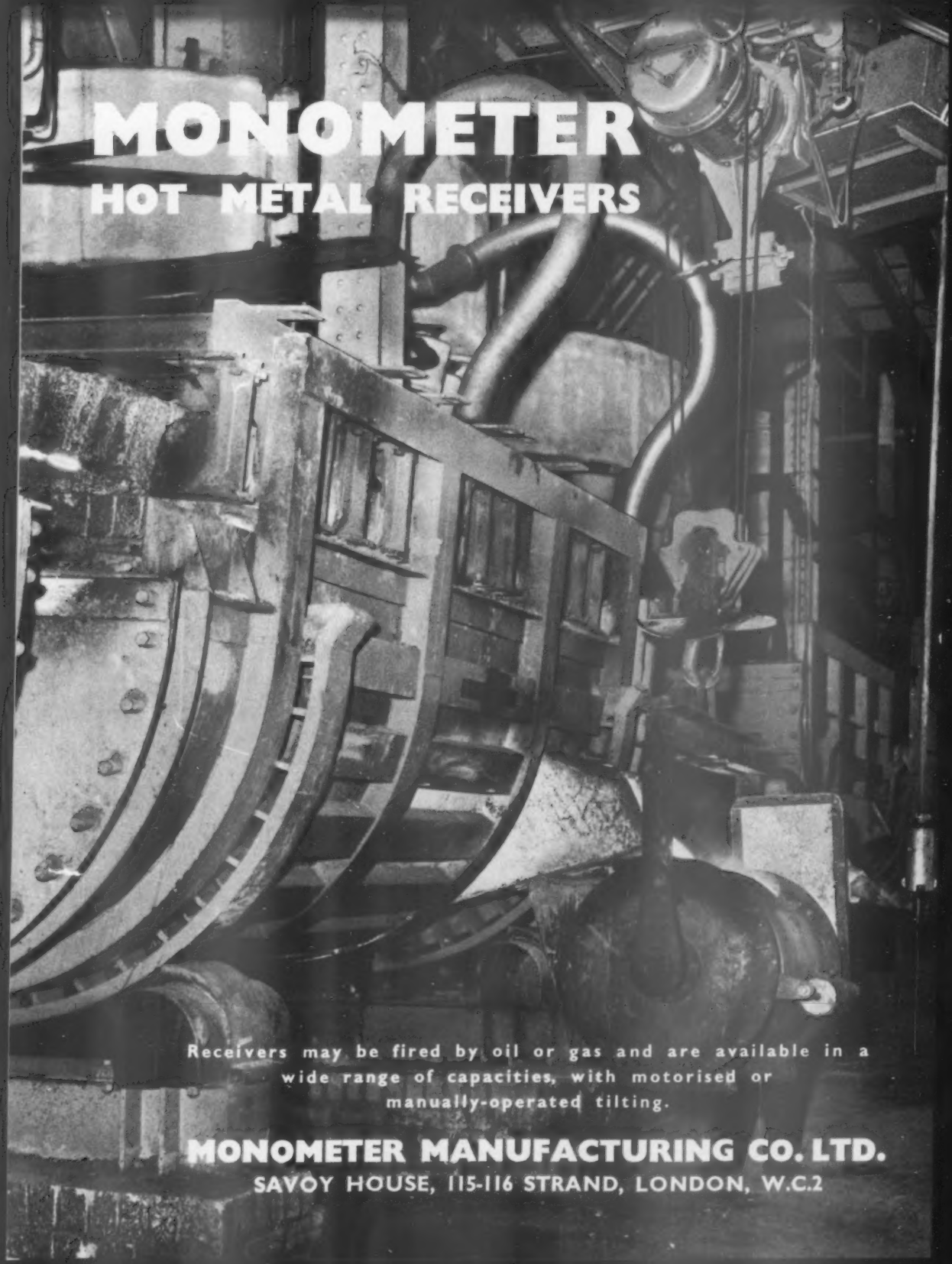

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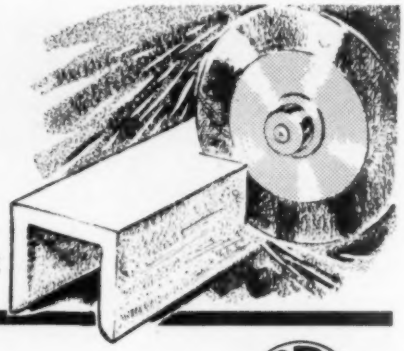

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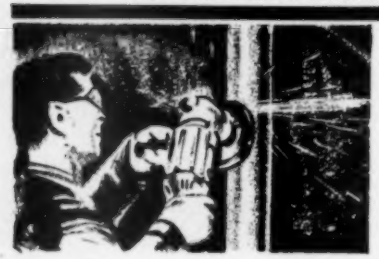

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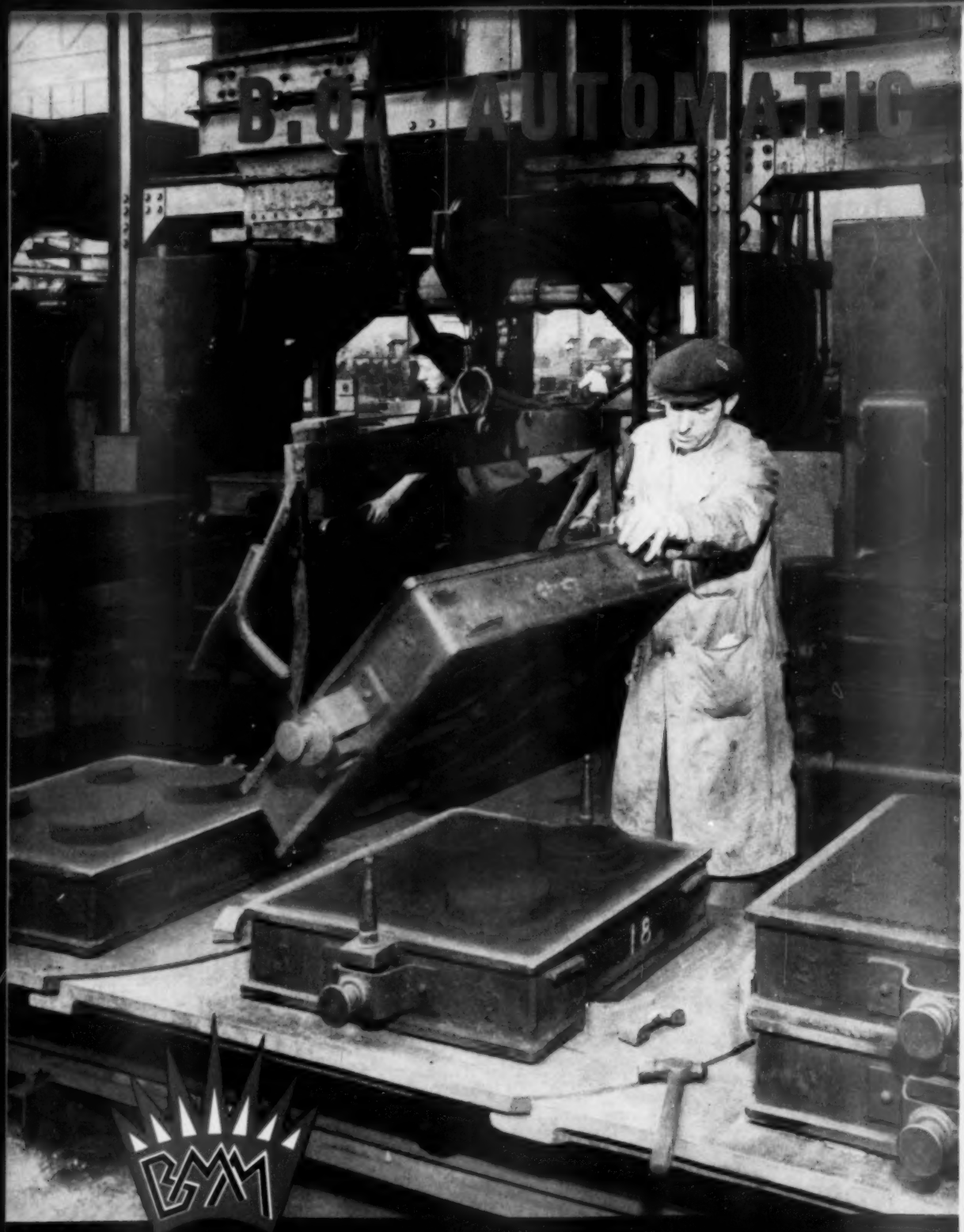

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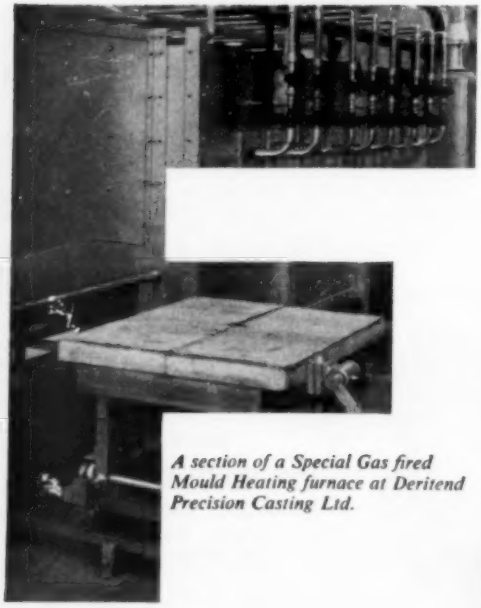

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PRINCIPAL CONTENTS

PAGE

Effect of Tin on the Mechanical Properties of Pearlitic Nodular Iron

By J. C. Prytherch Ph.D., M.Sc., F.I.M. and G. N. J. Gilbert, A.M.I.Mech.E., A.I.M.

Report of the joint work undetaken by the British Cast Iron Research Association and the Tin Research Institute into a problem on which divergence of views had previously become apparent 197

Electric Steel—Degassing and Furnace Maintenance

Abstracts from two papers on practical aspects of foundry steel production presented to the American Institute of Mining, Metallurgical and Petroleum Engineers 207

Fifty-eighth IBF Annual Conference

Details of the programme for the conference to be held in Cheltenham, May 15 to 18 210

Effets de l'étain sur les propriétés mécaniques de la fonte perlitique à graphite sphéroidal. Par J. C. Prytherch, Ph.D., M.Sc., F.I.M., et G. N. J. Gilbert, A.M.I.Mech.E., A.I.M. Rapport sur le travail entrepris conjointement par l'Association britannique de Recherche pour la Fonte et l'Institut d'Etudes de l'Etain, sur un problème pour lequel des divergences de vues s'étaient révélées auparavant. 197

Acier au four électrique . . . Dégazage et entretien du four électrique. Extraits de deux mémoires sur les aspects pratiques de la production de fonte d'acier, présentés à l'Institut américain des ingénieurs des mines, métallurgistes et ingénieurs de pétrole. 207

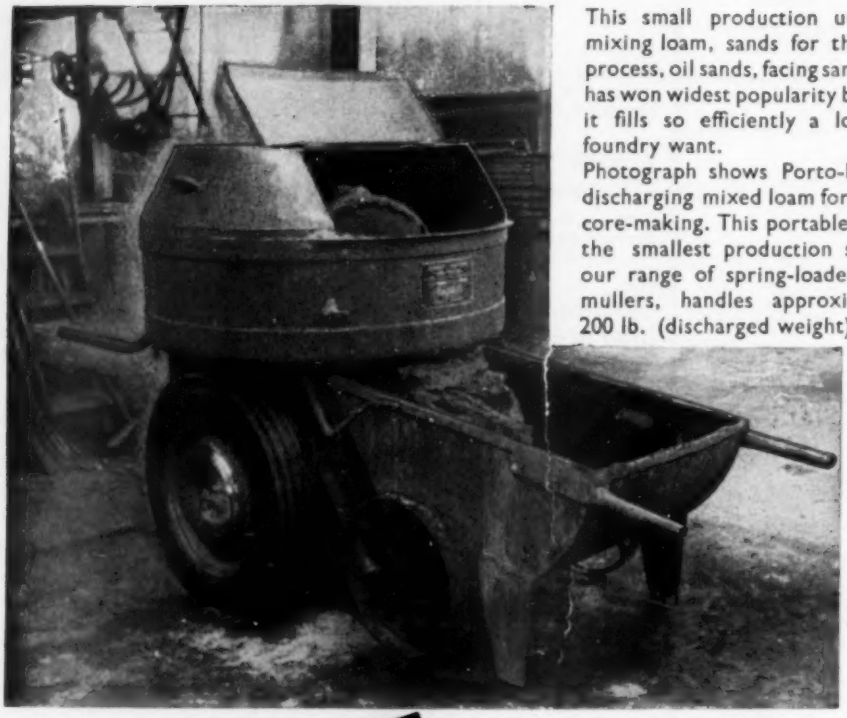
Der Einfluss von Zinn auf die mechanischen Eigenschaften von perlitischem Gusseisen mit Kugelgraphit. Von J. C. Prytherch, Ph.D., M.Sc., F.I.M., und G. N. J. Gilbert, A.M.I.Mech.E., A.I.M. Ein Bericht über Versuchsarbeiten, welche in Zusammenarbeit des englischen Gusseisenforschungsinstitutes mit dem Zinnstudieninstitut zur Aufklärung eines Problemes unternommen wurden, bei welchem früher das Bestehen einander widersprechender Ansichten in Erscheinung getreten war. 197

Elektrostahl . . . Entgasung und Ofeninstandhaltung. Kurzauszüge aus zwei Vorträgen über die praktischen Gesichtspunkte der Stahlgusserzeugung, welche vor der amerikanischen Vereinigung der Bergwerks-, Hütten-, und Petroleumingenieure gehalten wurden. 207

Features, News, Commercial Information and Statistics

Leader: Brass and Bronze Research Sponsorship 195
Correspondence: Skill Where it's Needed 196
Dinner: Foundry Coke Merchants' Association 196
Forthcoming Events 196
Company News 213
Equipment and Supplies 214
Twenty-one-years' Association Celebrated 215
BISRA " Open Days " 215
EEC Apprentice Training 215
Armstrong Whitworth's New Roll Foundry 215
News in Brief 216
American Letter 218
Success with an Awkward Casting 220
Machine Tool Industry Research Association 220
Steel-processing Plant for Hadfields 220
British Standards Institution 220
Raw Material Markets 222
Current Prices of Iron, Steel, and Non-ferrous Metals 224
Personal 226

The portable unit for perfect SAND MIXING



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FOUNDRY
TRADE JOURNAL
Vol. 110 February 16, 1961 No. 2306

Brass and Bronze Research Sponsorship

British copper-base founders have been somewhat disturbed by losses which their industry has suffered through competition from plastics and other relatively new materials and processes. It would seem that their American counterparts are much better served for research and service than they, as in the USA, the Brass and Bronze Ingot Institute undertake some of the responsibility of conducting technological research and Press propaganda in this field. Their effort started some 30 years ago and since that time, something like £142,000 or about £4,700 a year, has been spent on pure research—though this is not a vast amount for a great Continent. The research has been carried out at the Battelle Memorial Institute and initially was designed to furnish founders with badly-needed data on the mechanical properties of sand-cast copper alloys. During the period 1944 to 1954, Battelle evaluated many factors including metal composition, mould materials, types of furnaces and crucibles, cooling rates of mould materials, character of metal charges, method of charging, rate of power consumption, etc.

As a programme, it would be difficult to envisage anything more generally acceptable to the non-ferrous foundry owners and it is interesting to learn that since 1955 research is being prosecuted in the same manner to produce authoritative data on the properties of standard brass and bronze casting-alloys, equally suited for use by the foundryman, metallurgist, design engineer and architect. In addition to technological investigations, the Brass and Bronze Ingot Institute (of America) has conducted market research and has instituted a series of scholarships in foundry practice administrated by the Foundry Educational Foundation. A further activity under this heading is in public relations, using the various channels open for publicity, though no mention is made of buying space in the Press.

To carry out similar work in the United Kingdom, taking into account that one is catering for a country and not a continent—and also the difference in the local purchasing power of the dollar and the pound—it would appear that about £3,000 to £3,500 per annum would have to be raised. A public relations officer (part-time) would cost say £1,500 a year and a couple of scholarships say £1,000 a year. Thus, to do the equivalent amount of work a minimum total of £6,000 a year would be required. This is not too large a sum to ask from the brass and bronze foundry industries and those associated with them.

Correspondence

To the Editor of the FOUNDRY TRADE JOURNAL

SKILL WHERE IT'S NEEDED

SIR,—One of the most popular complaints in the foundry industry is concerned with the apparent drop in skill of foundry labour and in particular of moulders and coremakers. I am under a strong impression that in this complaint there is insufficient appreciation of the full picture.

Of course it is true that an average coremaker or moulder knows less or rather does not need to have all the skill required, say, 20 or even 10 years ago. However, it can be claimed that the core itself to-day has a much greater "skill" content than ever before. The essential point is that the skill has moved; it has shifted from one place or man to another—in the case cited, from the coremaker to the plant designer or to the corebinder manufacturer.

This "shift of skill" can be noticed everywhere that skill is applied; in the kitchen and household; in transport and communication; in offices; medicine, and in manufacturing industry. In all spheres, skill is moving from the consumer or user to the supplier. To-day, less skill is required to run a household, a car, to work in an office, or to make a core than was needed yesterday, but more skill is required to make the household appliances, office machines and foundry plant and corebinders. The son of the old highly-skilled moulder may work as a designer of a 'slinger; the son of the coremaker perhaps produces cold-setting binders which make unnecessary his father's laboriously acquired skill. One should not worry that a lower amount of skill is needed for certain operations. Skill is still the major requirement in making a casting and, indeed, in total more of it is demanded—just compare to-day's specifications for metal and castings with those of 10 years ago, or the time needed to make a casting to-day and 10 years ago!

The present trend is a result of high employment and high labour cost; it is made possible by technical development and new raw materials; it is an index of progress and affects our lives much more than is generally realized and every year to a greater extent. Commonly called "push-button technique" or in another field "tinned ideas," it is a truly evolutionary process, helped by narrower and always narrowing specialization—both scientific and technical.

Yours, etc.,

DAVID EPSTEIN.

London, N.W.2.

Mining and Metallurgical Congress

The seventh Commonwealth Mining and Metallurgical Congress, to be held in Johannesburg from April 10, is expected to be the largest ever held in the Union. According to latest registration figures, 1,125 delegates, including 396 from abroad, will attend. There will be about 60 delegates from Britain. Special transport has been reserved for tours in South Africa, S.W. Africa and the Rhodesias, and a hotel in Witwatersrand has been taken over for the visitors. About 90 papers will be read at the Congress. The first 27 days will be based on Johannesburg and the next 14 will be spent in the Rhodesias. The Congress is being promoted by the Governments of South Africa and the Federation of Rhodesia and Nyasaland, and the Transvaal and Orange Free State Chamber of Mines.

Forthcoming Events

FEBRUARY 20

Institute of British Foundrymen

East Anglian section:—"Developments in the Production of Gunmetal Castings," by F. Hudson, F.I.M., 7.30 p.m., at the Civic College, Grimwade Street, Ipswich.

FEBRUARY 21

West of England Metallurgical Society

"Metallurgy in Modern Jewellery," by Miss D. Pile, 7.30 p.m., the College of Technology, Ashley Down, Bristol, 7.

FEBRUARY 22

Manchester Metallurgcal Society

"Metallurgical Applications of Radio-isotopes," by M. C. Inman, 6.30 p.m., at the Manchester Literary and Philosophical Society, George Street, Manchester.

Institute of British Foundrymen

Birmingham branch:—"Properties of Clay-bonded Moulding Sands at High Temperatures," by R. G. Godding, 7.15 p.m., at the James Watt Memorial Institute, Great Charles Street.

London branch:—"Production and Applications of Spheroidal-graphite Iron Castings in a General-engineering Firm," by H. Turner and P. Savage, 7.30 p.m., at the Constitutional Club, Northumberland Avenue, W.C.2.

FEBRUARY 23

Institute of Metals

"Theory of the Alloys of Copper," by Prof. W. Hume-Rothery, 6.30 p.m., in the Lecture Theatre, The Royal Institution, Albemarle Street, London, W.1.

Institute of British Foundrymen

Northampton section:—"Work of the Technical Council of the Institute," by M. M. Hallett, 7.30 p.m., at the Technical College, Wellingborough

Wales & Monmouth branch:—Film and discussion on the CO_2 Process, 7 p.m., at the Engineers Institute, Park Place, Cardiff.

FEBRUARY 24

Foundry Trades' Equipment & Supplies Association:—Annual dinner at the Savoy Hotel, Strand, London, W.C.2, 7 for 7.30 p.m.

Institute of British Foundrymen

Falkirk section:—A programme of films presented by N. Curry, B.SC., 7.30 p.m., at the Temperance Cafe, Lint Riggs.

Dinner

FOUNDRY COKE MERCHANTS' ASSOCIATION

About 240 members and guests were present at the twelfth annual banquet of the Foundry Coke Merchants' Association held on February 9 at the May Fair Hotel, London, W.1. The chairman, Mr. J. William Bell, proposed both the loyal toast and "The Guests" to which responses were made by Mr. G. R. Shotton, F.I.M., president of the Institute of British Foundrymen, and Mr. D. J. Ezra, M.B.E., director-general, marketing, NCB, respectively. Mr. F. Arnold Wilson, proposed the toast to the Association and Mr. M. G. Locket replied. The list of special guests included Mr. W. Armstrong; Mr. T. C. Edwards, F.I.CERAM.; Mr. D. L. Farrant; Mr. W. E. Fawcett, F.C.I.S.; Mr. J. Y. Feggetter; Mr. R. J. Godson; Mr. C. B. Hardwick; Mr. F. Barrington Hooper, B.A.; Mr. H. H. Prosser; Mr. W. Ruddick; Mr. F. Wilkinson, and Mr. J. I. Willis. In the cabaret show after the banquet, Syd Marx provided "music, mirth and melody" and John Brearley, with Emilie Benfield at the piano, lived up to his billing of a "barrel of fun." Barrie Manning presented a floor show.

Effect of Tin on the Mechanical Properties of Pearlitic Nodular Iron

By J. C. Prytherch, PhD., M.Sc., F.I.M. and G. N. J. Gilbert A.M.I.Mech.E., A.I.M.**

Considerable divergence of views has become apparent in recent years in the world's technical literature concerning the effect of tin in cast iron. On one aspect of this matter—as regards properties of pearlitic nodular iron in relation to tin content—the following joint work by members of the British Cast Iron Research Association and of the Tin Research Institute will serve to clarify present thoughts. The report is accompanied by a mass of data supporting the conclusions.

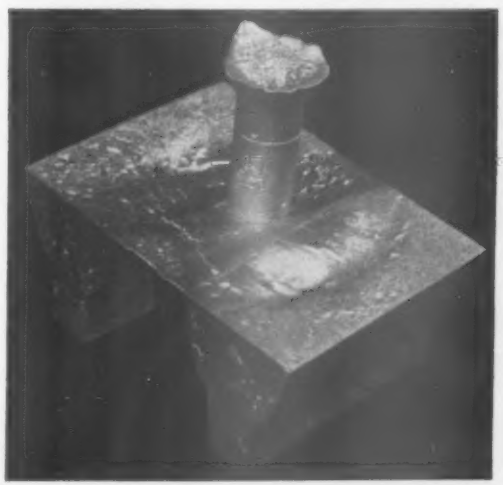
In both grey and nodular cast irons tin is a strong pearlite promoter and additions of 0.1 per cent. tin will completely suppress the formation of free ferrite without any risk of producing free cementite.[1-4] The change in mechanical properties resulting from the addition of tin to an iron with some free ferrite will, therefore, be dependent on both the tin in solution in the iron, and the structural changes produced by tin. Previous work[2, 4] on the changes in mechanical properties of some grey and nodular cast irons has not attempted to distinguish betwen these two effects, but in the present work the influence of tin additions has been determined for a number of nodular irons which were almost completely pearlitic without any tin addition. The observed changes in mechanical properties are, therefore, associated with tin in solution rather than with structural changes.

Normally, with certain exceptions, as explained below, pearlitic nodular irons containing less than 5 per cent. of ferrite have a tensile strength in the as-cast condition of 45 to 48 tons per sq. in. and an elongation of two to five per cent. Before use, these irons are frequently normalized at 850 to 900 deg. C. and this treatment has been shown to increase the tensile strength to 55 to 65 ton per sq. in. and slightly greater elongations are obtained.[7]

All ferrous materials, except grey cast irons and austenitic materials, exhibit a transition from ductile to brittle behaviour over a certain range of temperature, which may be above or below room temperature. For a given material the temperature of transition increases with increasing speed of loading, and a higher transition temperature is obtained in a notched impact test than in an unnotched test. Fully-pearlitic materials have high ductile-to-brittle transition temperatures in relation to ferritic materials and Pellini[5] has shown that they may have transition temperatures in the notched impact test above 100 deg. C. Should the ductile-to-brittle transition temperature be sufficiently high, a material may be in the transition range in the normal unnotched slow tensile test at room temperature, resulting in a reduction in tensile strength.[6] Previous work[6] has shown that in certain pearlitic nodular cast irons an increase in silicon content could reduce the tensile strength at room temperature, due, apparently, to a raising of the ductile-to-brittle transition temperature. A similar effect had also been found due to the presence of 0.1 per cent. of tin in pearlitic nodular iron having 2.21 per cent. silicon. Normalizing appeared to remove these embrittling influences.

In the present work a series of tin additions up to 0.25 per cent. have been made to a series of pearlitic nodular irons containing different amounts of silicon and the effects on mechanical properties in both the as-cast and normalized condition have been determined.

FIG. 1.—*One pair of keel-block test bars, as-cast, produced from a closed-top mould.*



* The authors are attached, respectively, to the British Cast Iron Research Association and the Tin Research Institute.

Tin in Pearlitic Nodular Cast Iron

Materials and Test Bars

Materials containing 1.4, 1.9 and 2.5 per cent. silicon were produced from three 1,000 lb. high frequency melts using charges of steel scrap which were recarburized by adding Dohm carbon. Ferro-alloys were added to adjust the silicon and manganese contents. From each melt six 160 lb. taps were taken when the furnace temperature was 1,480 deg. C. and the following additions of pure tin were made to the ladle before pouring the metal from the furnace: Tap 1—none, tap 2—40 gm, tap 3—8 gm, tap 4—120 gm, tap /— 160 gm, tap 6—200 gm.

Each ladle of metal was treated with 1 lb. 6 oz. of nickel-magnesium alloy containing 17 per cent. magnesium at a temperature of 1,400 deg. C. When the reaction had subsided a 0.5 per cent. addition of silicon as 80 per cent. ferro-silicon, together with 20 gm of cerium mischmetall, was plunged into the ladle. The ladle was allowed to stand for one minute for the slag to rise to the surface before pouring the metal into the mould at a temperature of 1,350 deg. C.

From each ladle of metal four keel-block castings were poured. The keels were cast in pairs, using closed-top moulds with a flash gate the full length of one top edge. A pair of keels is shown in Fig. 1. The dimensions of a keel are shown in Fig. 2, which also illustrates how tensile bars and impact specimens were cut from the test bars. One pair of keels from each tap was cut up as shown in Fig. 2 to obtain two 0.564-in. dia. tensile bars and 18 unnotched impact specimens 10-mm. square by 60-mm. long, which were tested on a 40 mm. span. One tensile bar had threaded shoulders and was used for proof stress determinations, and the other had plain shoulders and was used only for tensile stress determinations. The impact specimens were similar to the standard Charpy specimens specified in BS 131, except that they were unnotched.

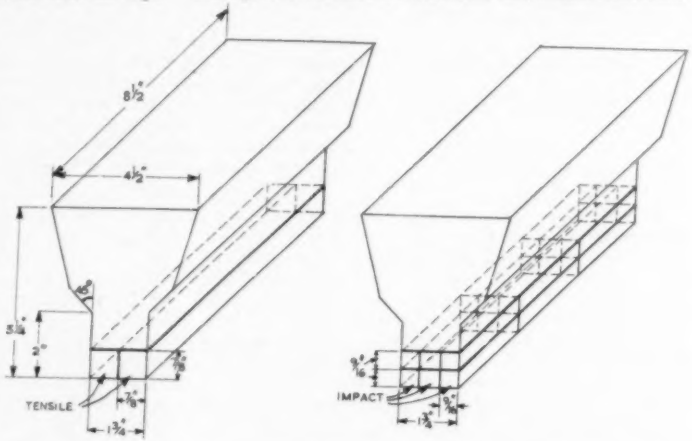
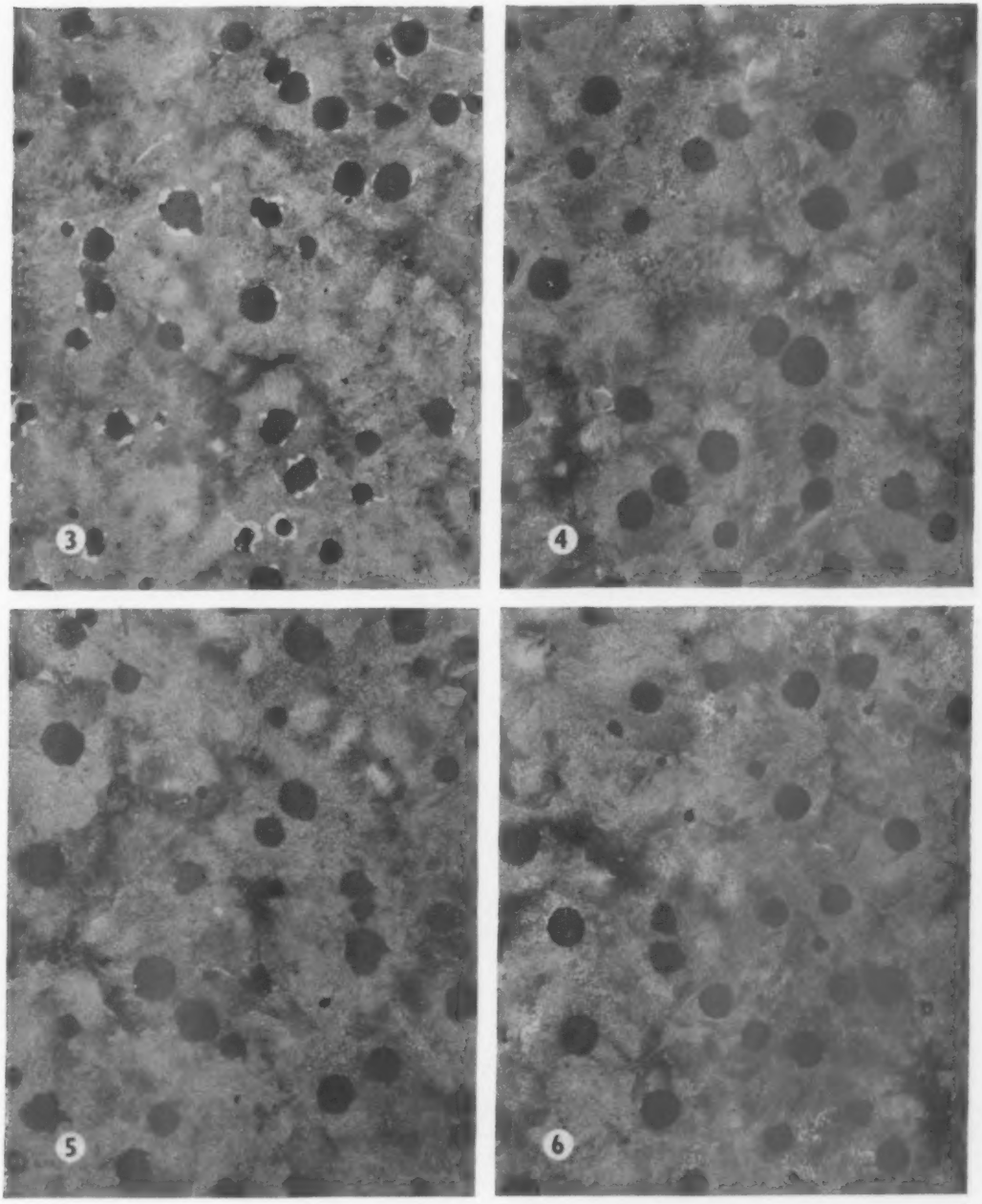


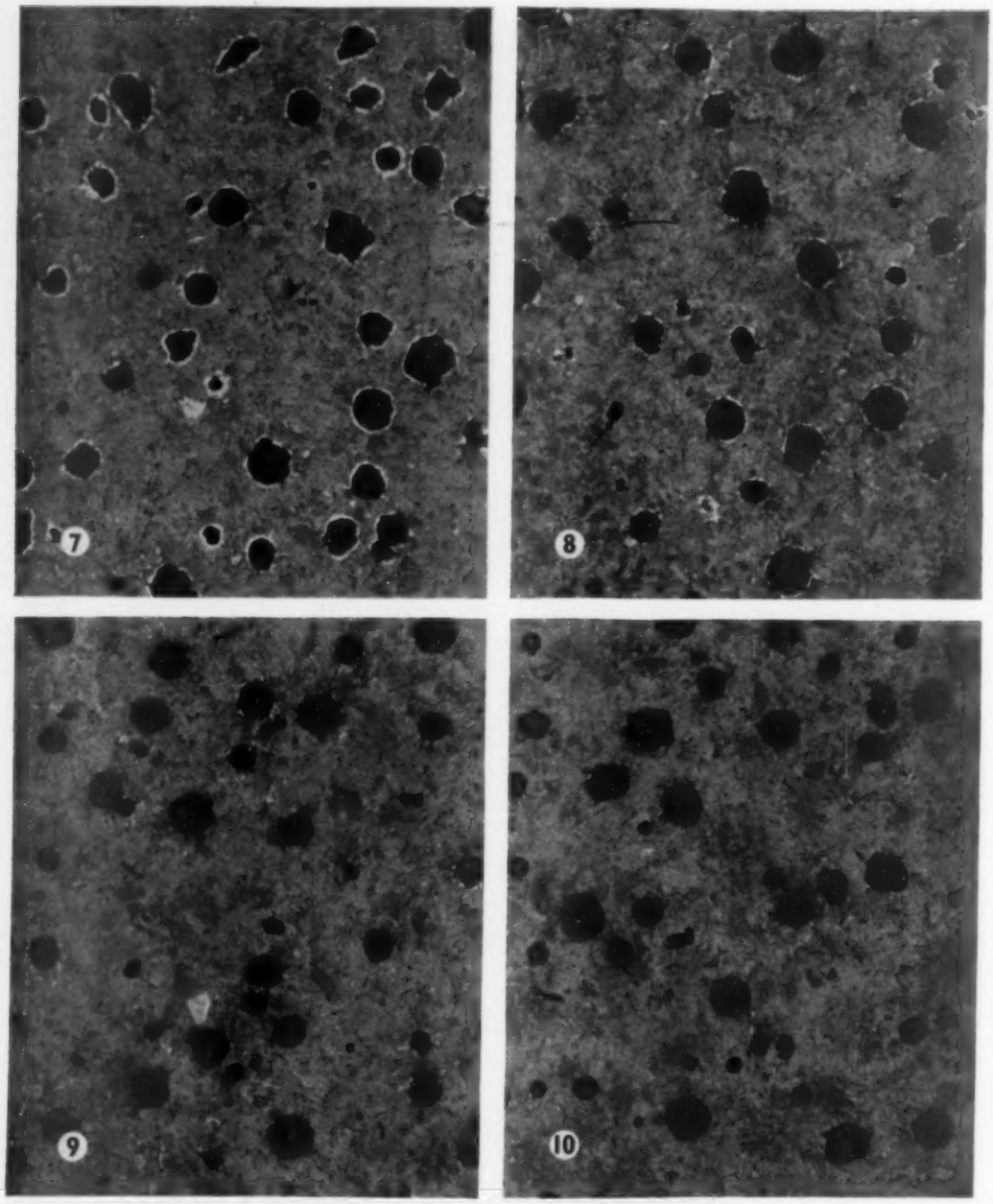
FIG. 2.—*Diagram to illustrate how the keel-blocks were cut up to provide the tensile bars and impact specimens.*

TABLE 1.—*Chemical Composition.*

Tap No.	T.C. per cent	Si, per cent.	Mn, per cent.	S, per cent.	P, per cent.	Ni, per cent.	Mg, per cent.	Ce, per cent.	Sn, per cent.
1.4 per cent. silicon series									
1	3.45	1.34	0.37	0.109	0.020	0.71	0.047	<0.003	<0.005
2		1.38	0.36			0.74	0.045		0.049
3		1.38	0.37			0.79	0.045		0.092
4		1.36	0.38			0.76	0.045		0.130
5		1.37	0.38			0.80	0.046		0.200
6	3.23	1.38	0.37	0.025	0.020	0.76	0.046	<0.003	0.230
1.9 per cent silicon series									
1	3.57	1.95	0.40	0.019	0.026	0.79	0.052	<0.003	<0.005
2		1.97	0.42			0.79	0.055		0.054
3		1.88	0.42			0.81	0.051		0.085
4		0.95	0.40			0.79	0.051		0.130
5		1.93	0.42			0.82	0.054		0.200
6	3.35	1.91	0.42	0.020	0.024	0.84	0.056	<0.003	0.260
2.5 per cent. silicon series									
1	3.44	2.46	0.31	0.023	0.026	0.83	0.049	<0.003	<0.005
2		2.48	0.32			0.82	0.051		0.049
3		2.40	0.33			0.80	0.051		0.082
4		2.57	0.32			0.79	0.050		0.150
5		2.43	0.34			0.79	0.055		0.190
6	3.22	2.60	0.33	0.019	0.022	0.85	0.051	<0.003	0.250
2 5 per cent. silicon series (Additional set)									
1	3.54	2.35	0.36	0.019	0.018	0.71	0.067	<0.003	<0.005
2		2.39	0.36			0.73	0.051		0.053
3		2.34	0.36			0.73	0.053		0.094
4		2.34	0.36			0.76	0.050		0.130
5		2.42	0.37			0.75	0.050		0.160
6	3.40	2.39	0.37	0.024	0.020	0.77	0.051	<0.003	0.210



FIGS. 3 *to* 6.—*As-cast micro-structures of* 1.9 *per cent. silicon iron in the pearlitic condition. The respective tin contents of the samples are as follow:*—FIG. 3) <0.005 *per cent., i.e., almost tin free.* (FIG. 4) 0.054 *per cent.* (FIG. 5) 0.085 *per cent.* (FIG. 6) 0.130 *per cent. The influence of the small percentage of ferrite in breaking the regularity of outline of the graphite nodules is very noticeable in Fig.* 3



FIGS. 7 *to* 10.—*Normalized micro-structure of* 1.9 *per cent. silicon iron in the pearlitic condition. These contain the same tin contents as the samples shown in Figs.* 3 *to* 6, *i.e.*, <0.005, 0.054, 0.085, *and* 0.130 *per cent. respectively from Figs.* 7 *to* 10. *All the samples* (*Figs.* 1 *to* 10) *were etched with Picral and are at a magnification of* ×100.

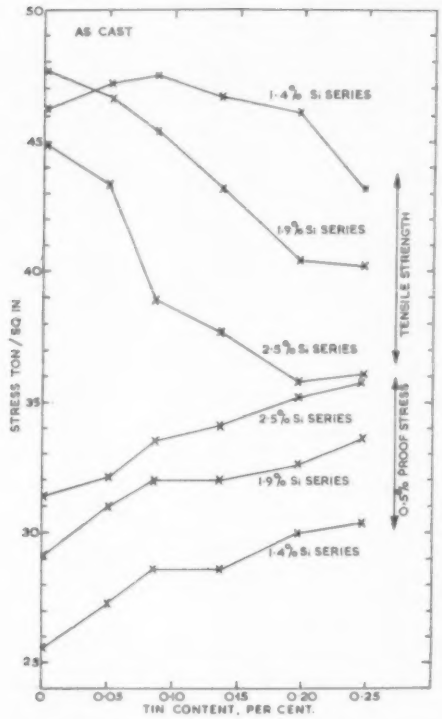


FIG. 11.—*Comparing the variation in 0.5 per cent. proof-stress and tensile-strength with tin content for irons in the as-cast condition containing different amounts of silicon.*

The second pair of keels was first sectioned into $\frac{7}{8}$-in. square by 8½-in. long bars or $\frac{5}{8}$-in. by 1½-in. plates, as shown in Fig. 2, and then given a normalizing heat-treatment consisting of holding at 900 deg. C. for six hours, followed by an air cool. Tensile and impact specimens were then machined in the same way as decribed above for the as-cast bars. A further melt was carried out and used to obtain additional impact specimens in a 2.5 per cent. silicon iron. The chemical compositions of all irons are given in Table 1.

Microstructures

All test bars had good nodular iron structures. Typical structures are illustrated for the 1.9 per cent. silicon series in Figs. 3 to 10. In the as-cast conditions the 1.9 per cent. silicon iron was pearlitic, containing about five per cent. of ferrite associated mainly with the graphite nodules. With the 0.054 per cent. tin the iron was completely pearlitic and with further additions of tin there was no appreciable change in microstructure. In the tin-free iron shown in Fig. 3 some nodules were almost perfectly round and others were irregularly shaped. The irregularly shaped nodules were associated with areas containing ferrite. As the iron became completely pearlitic with tin additions, all the nodules became almost perfectly round, as shown in Figs. 4 to 6. In the as-cast irons the pearlite did not etch uniformly and showed segregations at the grain boundaries.

In the normalized condition the tin-free iron containing 1.9 per cent. silicon had about five per cent. ferrite present, as shown in Fig. 7. There was less than five per cent. ferrite present with 0.049 per cent. tin and only a trace of ferrite with 0.085 per cent. tin, as shown in Figs. 8 and 9. Irons with higher tin contents were totally pearlitic, as shown in Fig. 10. The structures of the 1.4 per cent. silicon series were similar to those illustrated for the 1.9 per cent. silicon irons, except that there was only a trace of ferrite present in the as-cast condition in the tin-free iron, and 0.049 per cent. tin was sufficient to make the structure completely pearlitic. The normalized irons had very similar structures to those shown in Figs. 7 to 10. The 2.5 per cent. silicon before additions of tin was 15 per cent. ferritic, the 0.049 per cent. tin iron

FIG. 12.—*Comparing the variation of elongation (top) and hardness (bottom) in as-cast irons with different tin contents, at various silicon levels.*

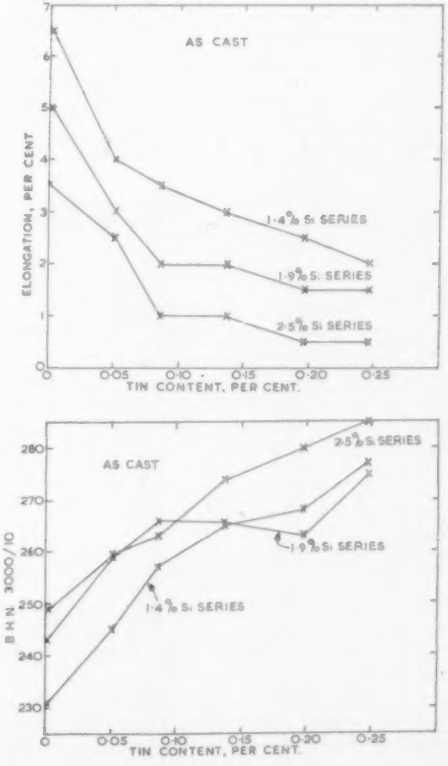


TABLE 2.—*Physical Properties of the Materials Tested—As cast and Normalized—in Relation to Tin Content.*

Tap No.	As-cast. Proof stress, tons per sq. in. 0.1 per cent.	0.2 per cent.	0.5 per cent.	Tensile stress, tons per sq. in.	Elongation, per cent.	Brinell Hardness No. 3000/10.	Normalized. Proof stress, tons per sq. in. 0.1 per cent.	0.2 per cent.	0.5 per cent.	Tensile stress, tons per sq. in.	Elongation, per cent.	Brinell Hardness No. 3000/10.	Tin content, per cent.
1.4 per cent. silicon series													
1	21.2	22.8	25.6	46.3	6.5		31.2	33.0	36.6	59.2	5.5	283	<0.005
1				46.5	6.0	231				60.2	5.0	280	
2	22.1	24.0	27.3	47.2	4.0		33.0	36.8	38.8	62.0	5.5	295	0.049
2				47.4	4.5	245				61.8	5.5	293	
3	22.6	24.8	28.6	47.5	3.5		34.0	36.0	40.2	62.9	4.0	319	0.092
3				47.6	3.5	257				63.0	4.5	298	
4	22.8	24.8	28.6	46.7	3.0		34.4	36.4	40.6	63.7	4.5	317	0.130
4				45.0	2.5	265				64.7	3.5	306	
5	24.2	26.2	30.0	46.1	2.5		36.2	38.4	42.8	65.1	3.0	321	0.200
5				46.2	3.0	268				61.3*	3.5	309	
6	24.6	26.8	30.4	43.2	2.0		36.2	38.8	42.6	61.9	3.0	329	0.230
6				43.8	2.0	272				62.1	3.0	321	
1.9 per cent. silicon series													
1	24.3	26.2	29.2	47.7	5.0		33.4	35.4	38.5	59.7	5.0		<0.005
1				45.9	4.0	243				60.8	5.0	290	
2	25.4	27.2	31.0	46.7	3.0		35.6	37.7	41.0	63.0	5.5		0.054
2				45.2	2.5	259				61.0	4.0	298	
3	26.5	28.6	32.0	45.4	2.0		35.8	38.2	42.2	62.5	3.0		0.085
3				44.8	2.0	266				64.4	4.0	307	
4	26.9	28.3	32.0	43.2	2.0		37.7	39.8	43.4	61.6	2.5		0.130
4				43.2	2.0	265				62.0	3.0	311	
5	27.4	29.4	32.6	40.4	1.5		40.0	42.0	45.9	58.9	2.0		0.200
5				41.6	1.5	263				59.1	1.5	319	
6	28.2	30.9	33.6	40.2	1.5		41.3	43.3	47.1	56.4	1.5		0.260
6				38.8	1.0	275				57.8	2.0	325	
2.5 per cent. silicon series													
1	26.7	28.6	31.4	44.9	3.5		34.8	37.2	40.2	61.2	5.5		<0.005
1				46.6	4.0	249				60.1	6.0	292	
2	27.4	29.1	32.1	43.4	2.5		35.4	37.8	40.8	61.3	5.0		0.049
2				42.2	2.0	259				61.1	5.5	306	
3	28.6	30.3	33.5	38.9	1.0		37.0	39.4	41.6	62.3	4.0		0.082
3				40.2	1.0	263				58.5	3.0	307	
4	29.4	31.1	34.1	37.7	1.0		39.8	41.8	45.2	61.4	2.5		0.150
4				37.3	1.0	274				60.7	3.0	309	
5	29.8	31.6	35.2	35.8	0.5		41.0	43.4	47.2	57.5	1.5		0.190
5				35.2	0.5	280				55.0	2.0	321	
6	30.6	32.8	35.8	36.1	0.5		41.6	44.0	47.4	55.8	1.5		0.250
6				36.7	0.5	285				54.4	1.5	329	

* Small flaw.

TABLE 3.—*Impact Results at Various Temperatures to Show the Extent of Scatter to be Expected, 2.5 per cent. Silicon Series, As-cast.*

Temp., deg. C.	Charpy impact value, ft.-lb. 1 8n, <0.005 per cent.	2 8n, 0.049 per cent.	3 8n, 0.082 per cent.	4 8n, 0.150 per cent.	5 8n, 0.190 per cent.	6 8n, 0.250 per cent.
200	38.0	32.0	30.5	12.5	10.0	7.5
	37.5	38.0	21.0	13.0	10.0	8.0
	34.0	36.0	23.0	14.0	11.0	8.0
	37.0	34.0	22.0	14.0	12.0	
Average ..	36.6	35.0	24.1	13.4	10.7	7.8
100	30.0	24.5	8.5	6.5	5.5	5.0
	27.5	21.5	8.0	7.0	5.0	4.5
	31.0	24.0	11.5	7.5	5.0	4.0
	28.0	14.0	10.5	7.5	4.5	4.5
	30.5	15.0	10.0	8.0	4.0	
Average ..	29.4	19.8	9.7	7.3	4.8	4.5
20	17.0	6.0	5.0	4.0	3.5	2.5
	12.5	9.0	3.5	4.0	3.5	3.0
	13.0	6.0	4.5	4.0	3.0	3.0
	12.0	9.5	3.0	4.5	3.5	3.0
	16.0	8.0	4.5	4.0	3.0	
Average ..	14.1	7.7	4.1	4.1	3.3	2.9
—68	3.5	2.5	2.0	2.0	2.0	2.0
	3.5	2.0	2.0	1.5		
	3.5	2.5	2.0	2.0		
	4.0	3.5	2.5	2.5		
Average ..	3.6	2.6	2.1	2.0	2.0	2.0

less than five per cent. ferritic, and the 0.082 per cent. tin iron contained only a trace of ferrite in the as-cast condition. There was also more ferrite present in the normalized irons of this series. There was 10 per cent. ferrite in the tin-free iron and 0.049 per cent. tin iron, five per cent. ferrite in the 0.082 per cent. tin iron and only a trace of ferrite in the 0.150 per cent. tin iron. With greater tin additions all irons were entirely pearlitic.

Tensile and Impact Results

Two tensile tests were carried out on each iron. Tensile strength and elongation were determined on each, and on one specimen 0.1, 0.2 and 0.5 per cent. proof stresses were determined. The tensile results are given in Table 2. The impact tests were carried out using a 240 ft.-lb. Amsler Charpy machine using a 120 ft.-lb. capacity hammer with a striking velocity of about 18 ft. per sec. The impact specimens were unnotched and were 60-mm. long by 10-mm. square, and were tested on a 40-mm. span. These specimens were similar to the standard specimen according to BS 131, except that they were unnotched. Since few data were available to indicate the scatter obtained using these specimens for testing pearlitic nodular irons, and therefore the accuracy with which an impact-

TABLE 4.—*Impact Results 1.4 per cent. Silicon Series.*

(10 mm.-square × 60 mm.-long unnotched specimen broken on a 40-mm. span.)

Test temperature, deg. C.	As-cast impact, ft.-lb.						Normalized impact, ft.-lb.					
	Tap number and tin content, per cent.						Tap number and tin content, per cent.					
	1 <0.005	2 0.049	3 0.092	4 0.130	5 0.200	6 0.230	1 <0.005	2 0.049	3 0.092	4 0.130	5 0.200	6 0.230
200 ..	35.5	33.5	26.0	—	20.5	14.0	21.5	27.0	27.0	29.0	28.0	20.5
	31.0	32.0	23.5	21.5	14.0	16.5	26.0	30.5	27.0	28.0	21.0	22.0
140 ..	37.0	31.5	31.5	19.5	16.0	10.5	26.5	36.0	28.0	30.0	21.0	18.0
	37.0	28.0	21.5	20.0	14.0	10.0	30.5	30.5	31.5	28.5	27.0	17.5
120 ..	36.0	33.0	25.0	23.5	15.0	12.0	27.0	27.0	27.5	25.5	24.5	18.5
100 ..	29.5	29.0	25.5	25.5	12.0	7.5	30.0	33.0	26.5	29.5	29.5	20.5
	—	29.5	23.0	16.5	9.5	11.0	27.5	30.5	27.0	25.5	26.0	18.0
80 ..	—	—	—	14.5	11.0	6.5	—	—	—	—	20.5	—
60 ..	39.5	21.5	20.0	13.0	10.0	7.0	30.5	28.5	23.5	27.0	16.5	15.5
	39.0	24.5	20.0	10.5	7.5	7.0	30.0	31.5	33.0	31.5	18.0	16.5
40 ..	—	14.0	14.0	10.0	9.5	3.5	—	—	—	25.5	—	—
20 ..	29.5	12.5	10.0	7.0	7.5	5.0	31.5	34.0	25.0	28.0	16.0	13.0
	26.5	11.0	9.0	7.0	4.5	4.5	—	30.5	33.0	20.5	14.0	11.0
0 ..	38.5	12.5	6.0	8.0	7.0	4.0	28.0	33.5	25.0	20.0	13.5	16.0
−20 ..	13.5	—	—	—	—	—	—	27.5	20.5	14.0	—	—
−40 ..	25.5	6.0	7.0	4.5	4.0	4.0	20.5	18.0	19.0	16.0	9.5	10.5
−60 ..	11.0	6.0	4.5	4.0	5.0	3.5	17.0	11.5	21.0	10.5	9.0	8.0
−80 ..	4.0	4.0	5.0	3.5	3.0	3.0	11.0	11.0	6.5	7.0	7.0	6.0
−100 ..	—	—	—	—	—	—	—	—	12.0	—	—	—

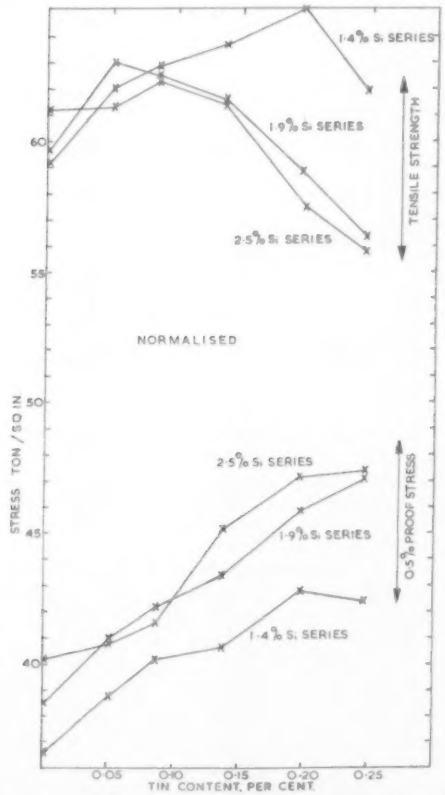


FIG. 13.—*Variation in 0.5 per cent. proof-stress and tensile strength with tin content for normalized irons. Compare with Fig. 11.*

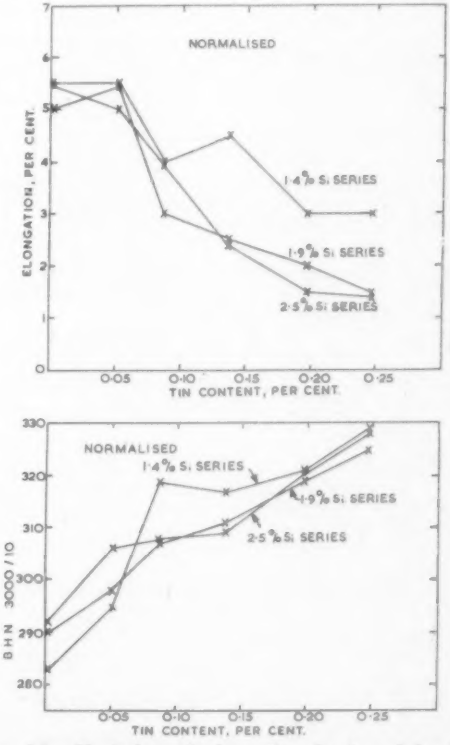


FIG. 14.—*Variation of elongation (top) and hardness (bottom) with tin content for normalized irons. Compare with Fig. 12.*

transition curve could be determined was not known, it was decided, first to carry out a series of tests to determine scatter. These were carried out on as-cast specimens of the 2.5 per cent. silicon material. Four or five impact results were obtained at four different temperatures to determine scatter

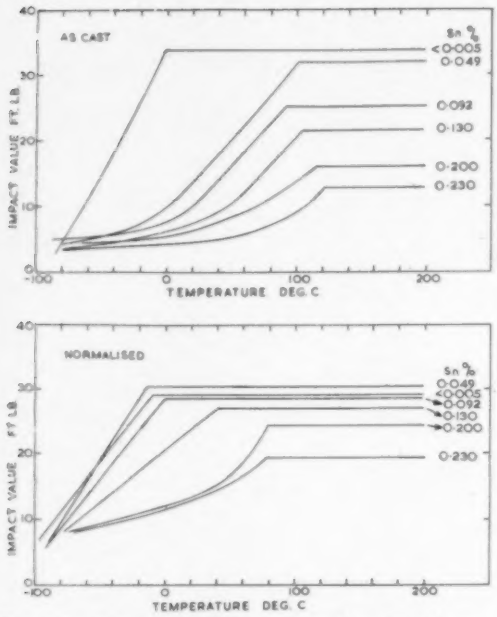
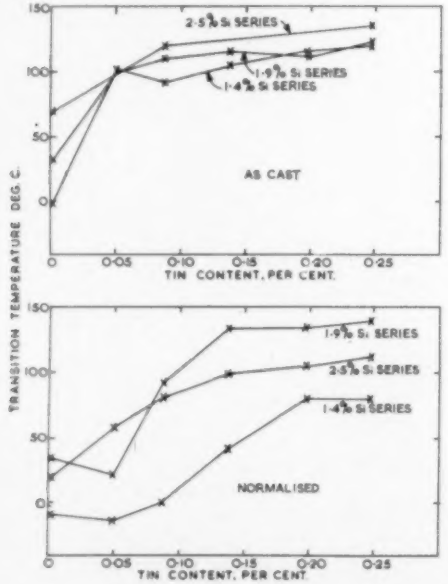


FIG. 15.—*Impact transition curves for the* 1.4 *per cent. silicon series comparing as-cast values* (*top*) *with the normalized* (*bottom*).

FIG. 16.—*Variation of the transition temperature with tin content for as-cast irons* (*top*) *with the normalized condition* (*bottom*).



at all impact levels. The results are given in Table 3, and show that the individual values did not differ greatly from the average values. In view of this it was considered that satisfactory transition curves could be obtained if duplicate or, in some cases, single impact tests were carried out over a range of temperatures differing by about 20 deg. C. Complete transition curves were determined on the remaining irons in the way described above. Further sets of specimens to replace the as-cast 2.5 per cent. silicon irons used to determine scatter, were prepared from an additional 2.5 per cent. silicon melt and transition curves were determined at three tin levels on this material. The impact results are given in Tables 4 to 6.

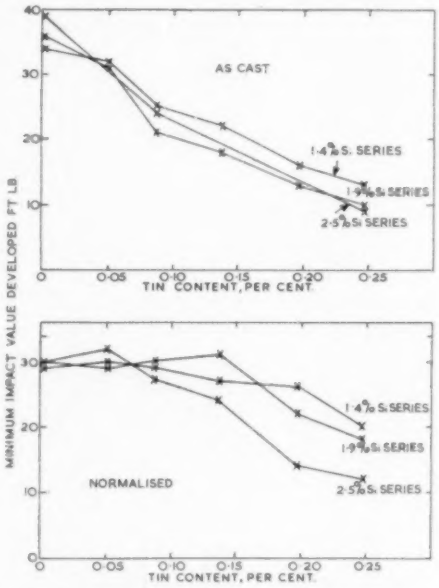


FIG. 17.—*Variation of the maximum value developed with tin content in the ductile range; as-cast* (*top*), *and normalized* (*bottom*).

Consideration of Results

In keeping with the results of other workers,[1-4] metallogprahic examination has shown that tin is a pearlite promoter; 0.08 per cent. tin was sufficient to suppress almost completely the formation of free ferrite (Figs. 3 to 10). Even in the alloys containing the highest percentages of tin, no free cementite was found in either the as-cast or normalized condition. In addition to preventing the formation of ferrite, tin also influenced the degree of perfection of the graphite nodules, making them almost perfectly spherical. In both the as-cast and normalized irons, the addition of tin progressively increased the proof stress and Brinell-hardness values, and in all irons the proof stress and hardness after normalizing was considerably greater than in the as-cast material (Figs.

TABLE 5.—*Impact Results* 1.9 *per cent. Silicon Series.*
(10-mm. square by 60-mm. long unnotched specimen broken on 40-mm. span.)

Test temperature, deg. C.	As-cast impact, ft.-lb.						Normalized impact, ft.-lb.					
	Tap number and tin content, per cent.						Tap number and tin content, per cent.					
	1 <0.005	2 0.054	3 0.085	4 0.130	5 0.200	6 0.260	1 <0.005	2 0.054	3 0.085	4 0.130	5 0.200	6 0.260
200 ..	36.0	33.0	24.0	16.5	18.5	11.0	27.0	26.5	33.5	34.0	29.5	17.5
	32.5	31.5	24.0	19.0	14.5	9.5	31.5	32.5	39.5	30.0	17.0	19.5
140 ..	33.5	27.5	19.0	18.5	13.5	8.0	27.0	32.0	27.0	25.5	27.5	17.5
	39.0	29.0	19.5	16.5	11.0	11.0	36.5	27.0	30.0	34.5	16.0	19.5
120 ..	35.5	32.0	21.0	17.0	10.0	7.5	30.5	17.0	29.5	23.0	18.0	13.0
	—	—	—	—	—	—	—	—	—	24.0	—	—
100 ..	27.5	27.5	20.0	12.0	9.0	5.5	32.0	39.5	28.0	27.0	12.0	13.0
	38.5	—	13.5	9.0	9.0	4.5	28.0	29.0	31.5	22.0	20.0	9.5
80 ..	—	13.0	13.5	10.5	7.5	6.5	—	—	17.0	—	10.5	8.0
60 ..	31.5	13.0	9.5	6.5	7.0	4.0	27.5	33.5	18.5	16.0	13.0	8.5
	41.5	13.0	10.5	6.5	7.0	4.0	31.5	23.5	18.5	19.0	17.5	9.0
40 ..	42.5	8.5	7.5	7.0	7.0	4.0	—	—	27.5	16.5	15.0	—
20 ..	22.5	9.5	5.5	5.5	4.5	3.5	21.5	30.5	14.5	15.0	9.5	8.5
	20.0	11.5	5.5	5.0	4.5	4.0	26.5	26.0	13.0	19.5	8.5	8.0
0 ..	11.0	7.0	4.5	4.5	4.0	2.5	19.0	20.5	12.5	15.0	7.5	6.5
−20 ..	15.5	—	—	—	—	—	18.0	15.5	—	—	—	—
−40 ..	4.0	4.5	3.5	3.0	2.5	2.0	15.0	14.0	13.0	10.0	5.5	5.5
−60 ..	4.5	3.5	3.5	3.0	2.0	2.0	13.0	10.0	8.0	8.0	5.0	4.5
−80 ..	—	—	—	—	—	—	14.0	9.0	6.5	5.0	5.0	3.5
−100 ..	—	—	—	—	—	—	9.0	8.0	—	—	—	—

TABLE 6.—*Impact Results* 2.5 *per cent. Silicon Series.*
(10-mm. square by 60-mm. long unnotched specimen broken on 40-mm. span.)

Test temp., deg. C.	As-cast impact, ft.-lb.						Normalized impact, ft.-lb.					
	Tap number and tin content, per cent.						Tap number and tin content, per cent.					
	1 <0.005	2 0.049	3 0.082	4 0.150	5 0.190	6 0.250	1 <0.005	2 0.049	3 0.082	4 0.150	5 0.190	6 0.250
200	51.5		28.0			10.0	29.5	34.0	35.5	27.5	10.5	11.5
	34.5		28.0			11.5	30.0	35.5	27.0	31.5	7.5	8.5
140	42.5		24.0			7.5	27.0	31.5	28.5	27.5	16.0	14.0
	35.0		20.0			6.0	34.0	30.0	30.0	18.0	15.0	11.5
120	36.5		22.5			7.0	34.5	32.5	23.5	22.5	16.0	11.0
100	46.5		10.0			6.5	24.0	34.0	27.0	23.0	13.5	9.5
	29.5		9.5			4.5	32.0	32.5	22.5	20.0	9.5	10.5
80	39.5		9.5			4.5	32.0		24.0	18.0	11.5	8.5
60	16.5		8.5			3.5	24.0	24.5	20.5	15.0	10.0	8.0
	22.0		9.5			3.5		23.5	22.5	15.0	12.0	7.5
40	29.5		5.5			3.5			19.0	14.0	9.0	8.0
20	27.0		4.0			2.0	17.0	32.0	12.5	13.5	10.0	5.5
	19.5		4.0			2.5	15.5	22.0	15.0	6.0	5.5	7.0
0	15.0		3.5			2.5	18.5	16.0	14.5	8.5	5.5	6.0
−40	7.5		3.0			1.5	7.5	14.0	10.0	4.0	4.5	3.5
−60	12.5		2.5			2.0	12.0	14.0	9.0	7.5	5.0	4.5
	5.0		2.5			2.0						
−80							8.0	7.5	5.5	5.0	4.0	2.5

11 to 14). The increase in 0.5 per cent. proof stress for each 0.1 per cent. tin addition was about 1.9 tons per sq. in. in the as-cast condition and 3.5 tons per sq. in. in the normalized irons. In both as-cast and normalized irons the hardness increased about 18 points Brinell for a 0.1 per cent. addition. In the as-cast condition the addition of a small percentage of tin (up to 0.092 per cent.) to the 1.4 per cent. silicon alloy increased the tensile strength, but larger percentages of tin gave a decrease in strength (Fig. 11). For both the 1.9 and 2.5 per cent. silicon series the tensile strength was reduced by the addition of tin in the as-cast irons. After the standard normalizing treatment, however, the 1.4 per cent. silicon series showed a progressive increase in tensile strength with increasing tin content up to 0.2 per cent. and in the 1.9 and 2.5 per cent. silicon series the tensile strength increased with tin additions up to about 0.1 per cent. (Fig. 13). Higher tin contents reduced the tensile strength. For all the irons, the elongation in the tensile tests decreased with increasing tin contents (Figs. 12 and 14).

Typical transition curves obtained on the 1.4 per cent. silicon material are shown in Fig. 15. The results of the impact tests on all materials followed a similar pattern, and are conveniently summarized by observing the change in transition temperature and maximum impact value, in the ductile range, with tin content (Figs. 16 and 17). In the as-cast materials the first effect of tin is to raise the transition temperature without appreciably decreasing the optimum-impact value obtained above the transition range. Above about 0.05 per cent., tin had little further effect on the transition temperature, but did have an effect on the toughness as shown by the decrease in maximum-impact values. The effect of tin in lowering the tensile strength of most of the as-cast irons (particularly those containing 1.9 and 2.5 per cent. silicon), is, therefore, associated with this increase in transition temperature and lowering the optimum-impact value. After

TABLE 7.—*The Variation of the Impact-transition-temperature and the Maximum-impact-value Obtained in the Ductile Range with Increase in Tin Content.*

Tin content, per cent.	As-cast.		Normalized.	
	Transition temperature, deg. C.	Maximum impact value.	Transition temperature, deg. C.	Maximum impact value.
1.4 *per cent. Silicon series*				
<0.005	0	34	−10	29
0.049	102	32	−14	30
0.092	92	25	0	29
0.130	105	22	42	27
0.200	116	16	80	26
0.230	120	13	80	20
1.9 *per cent. Silicon series*				
<0.005	32	36	34	30
0.054	100	31	22	29
0.085	110	21	92	30
0.130	116	18	134	31
0.200	112	13	135	22
0.260	122	10	140	18
2.5 *per cent. Silicon series*				
<0.005			20	30
0.049			58	32
0.082			82	27
0.150			100	24
0.190			106	14
0.250			112	12
2.5 *per cent. Silicon series*		(*Additional Set*)		
<0.005	70	39		
0.053				
0.094	120	24		
0.130				
0.160				
0.210	136	9		

normalizing, however, the effect of tin on both the ductile-to-brittle transition temperature and impact resistance was considerably less. The transition temperature for the 1.4 per cent. silicon series was not raised by up to 0.092 per cent. tin, and the maximum impact value in the ductile range was not reduced significantly until the tin content exceeded 0.20 per cent. In the irons of higher silicon content 0.05 per cent. tin had to be exceeded before any significant change in the transition temperature was obtained, and more than approximately 0.1 per cent. tin had to be present before the optimum-impact value began to fall significantly. As in as-cast irons, the tensile strength of normalized irons was related to both the transition temperature and the optimum-impact value obtained in the ductile range. Superior tensile properties were obtained in the normalized irons because larger additions of tin were required to cause a given increase in transition temperature or decrease in toughness.

Summary and Conclusions

The present investigation on pearlitic nodular irons has confirmed that small amounts of tin in nodular cast iron suppress the formation of free ferrite without producing massive cementite. Tin also increases the perfection of the graphite nodules. Tin additions progressively increase the hardness and proof stress of irons of all silicon levels, but the effect of tin on the tensile strength is related to the ductile-to-brittle transition temperature, and the toughness developed under impact conditions. From the mechanical test data it can be concluded that high silicon and tin contents together may be undesirable for certain applications. The normalizing treatments resulted in an increase in toughness and an iron embrittled by tin in the as-cast condition may have normal tensile strength after normalizing. From the range of irons tested it appears that embrittlement in the tensile test will not be present, after normalizing, in irons containing up to 0.1 per cent. tin. This is important, because this amount of tin is sufficient to give a fully pearlitic structure in irons which otherwise might contain free ferrite and, therefore, the addition of up to 0.1 per cent. tin either intentionally or as a trace element in the raw material will not have undesirable side effects. The beneficial effect of normalizing is probably associated with homogenization of the structure which occurs during heat-treatment.

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[5] Pellini, W. S., Sandoz, G., and Bishop, H. F. Transactions of the American Society for Metals, 1954, **46**, 418 to 445.
[6] Gilbert, G. N. J., and Palmer, K. B. *The British Foundryman*, 1957, **50**, 441.
[7] Gilbert, G. N. J., and Palmer, K. B. BCIRA *Journal of Research and Development*, 1957, **6**, No. 10, 498 to 504.

Sheffield Employment

Sheffield and District Employment Committee were told last month that there was no problem of unemployment at the moment. In iron and steel there was a vacancy list of 404, and the report stated, "The main point is that this industry is continuing to expand and we may well have difficulty in meeting labour demands during the year." Vacancies in general engineering, which employs 40,000, totalled 145, but the report said, "There is good reason to believe that the true demand is in excess of these figures, but employers, realizing the position, struggle along as best they can." It is stated that there was a large amount of systematic overtime in this section.

In engineers' small tools and cutlery, after a decline around Christmas, vacancies were building up. Silverware had a "standing" demand for both men and women, and training schemes had been introduced into a few firms. The recession in the motor-car industry appears to have had little effect so far on Sheffield employment. About 6,000 are employed by motor-car-accessory firms in Sheffield and district, and there are only about 200 on short time.

Figures of the East and West Ridings Region of the Ministry of Labour show that in Sheffield there are six vacancies for every five persons unemployed. There are 1,298 men and 447 women unemployed or on short time working out of an insured population of more than 295,000. At the beginning of 1960 the total was 2,955 with 535 fewer vacancies. The unemployed percentage is now 0.6.

Electric Steel . . . .

. . . . Degassing and Furnace Maintenance*

Practical Application of Modern Techniques to two Aspects of Steel Production for Foundry Purposes.

Electric-furnace Hearths and their Maintenance

By E. Franzen†

Maintenance of electric-arc-furnace hearths, or bottoms, is a controversial problem but is important for it determines the size of the melt and also has much influence on melting rate. This article illustrates the effect of different hearth-shapes on melting rates and presents some practices currently being used in the US to control furnace-hearth contour.

Types of Hearths

Illustrated in Fig. 1 is what the Author considers to be an ideal hearth-shape. As can be seen, the large central area, which is the actual floor of the hearth, is almost level from bank to bank, thus permitting heavy scrap charged first to be spread evenly across the bottom. A large flat area prevents the initial bath from rising too rapidly and tends to permit a build-up of temperature in the bath. A hot metal-bath, while the power source is near the bottom, favours early spread of melting and absorbs scrap over the entire flat area.

As shown in Fig. 2, heavy scrap piled high in the centre of the hearth may add from 15 to 30 min. to electrode "boring-through" time. Any heavy scrap left unmelted on the bottom of a furnace chills and "inactivates" the bath and slows the rate of melting. This can be circumvented somewhat by the use of lower transformer-tappings which produce low arc "flash" heat and introduce high power into the bath before it submerges the heavy scrap.

Fig. 3 illustrates a furnace hearth in which the scrap inclines towards the centre and causes it to bridge early in the melt, the angle of the banks inhibiting the natural sinking of the scrap. It takes only a short time to overheat a small pool of metal and begin to pull up the furnace bottom and cause spalling of the brickwork. From this cause, trouble can occur early in the melt, generally as a result of "bridging" of the scrap. If the banks are conical in shape, the scrap will have a tendency to roll and slide towards the central electrode cavity, resulting in a period of great and inefficient power-fluctuation, often resulting in breakage of electrodes caused by sliding scrap. Failure to maintain bank thickness at the slag-line area allows the banks to act as shelves for scrap (Fig. 4) and this often cannot be dislodged until metal is melted from beneath and then more delay occurs while the material is being melted after it falls into the bath.

Maintenance Problems

Disadvantages of operating a furnace with a high-bottom are numerous and costly—high tonnage cannot be attained; there is increased skulling of the charging pans; steel runouts occur during recharging and carbon removal by oxygen blow, and there is increased possibility of a breakout through the lining or a wash-out of the breast-plate. Probably, however, the greatest expense results from decreased roof and lining life. In the Author's opinion, the greatest cause of high bottoms is improper draining of the slag, and generally speaking, a few minutes on a medium/high power, plus the addition of flux just prior to tapping, would aid in getting good slag drain. A slag which has from 2 to 1 lime : silica ratio (V-ratio) tends to give a good trimming action to the furnace banks, but excessively limey slags, with V-ratios of 4 and higher, are almost impossible to drain properly. The most inexcusable cause of high bottoms is excessive build-up by furnacemen. A vertical contour between bank and lining should be maintained and high tapholes, which prevent proper draining, are a constant source of trouble. Means for removing taphole ridges either by mechanical reaming from the pit or floor side, or by oxygen lancing should be on hand at all times.

Removal of High Bottoms

High furnace-bottoms can best be avoided by the elimination of bad melting practices, which are the main cause of the problem. The charging of 10 to 20 per cent. blast-furnace iron or broken ingot moulds for several heats is generally effective in eroding heavy banks and the use of fluorspar is effective for cutting away excess bottom. Materials such as ferro-silicon and aluminium can be used directly on high spots, but tend to localize cutting and are also expensive. However, if a low-carbon melt is to be made, it can be charged early and acts in a similar manner to fluorspar in cutting away the banks. There are two fairly drastic and somewhat desperate means of removing high bottoms, used singly or in combination and these are as follow: On flats which are particularly high, the electrodes are run down and an arc is struck directly on the bottom, using one of the lower power tappings. A puddle of slag is thus formed under each of the electrodes and fluorspar, sand or silicon can be then shovelled in on the banks and flat. When a sizeable pool of slag is formed, the furnace is then drained. Generally, three holes

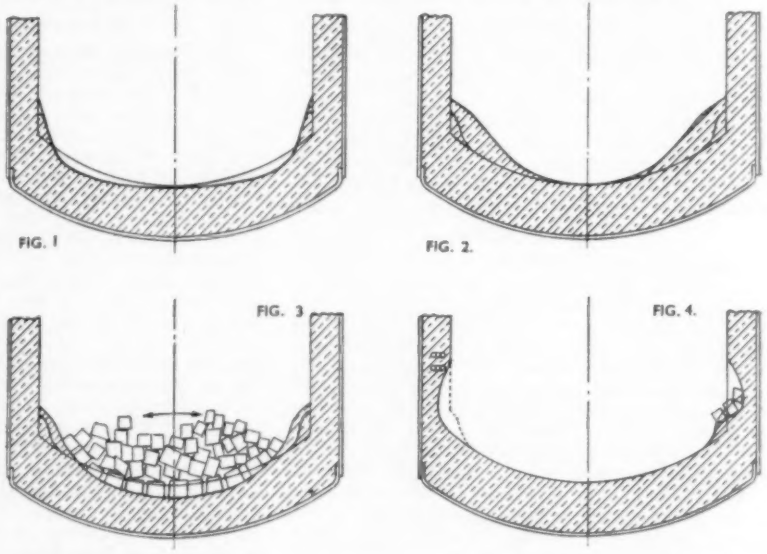
* Abstracts of papers presented at the Electric Furnace Conference, November 30 to December 2, 1960, in Chicago and sponsored by the American Institute of Mining, Metallurgical and Petroleum Engineers.

† The Author is superintendent of the electric furnaces at A. Fink & Sons Company, Chicago, Illinois.

Electric-furnace Hearths

are formed which break up the contours of the excess bottom and weaken it so it is more likely to be removed during the following melts. Bottoms may be deliberately "pulled" by placing a small hot-metal or scrap charge and heating it to excess. After superheating, the metal can then be drained or the furnace can be recharged. Experience has shown, however, that, generally speaking, deep holes are formed in small areas which are more damaging than beneficial. It is stressed that the two practices described are drastic and not to be recommended except as extreme measures.

FIG. 1.—*Ideal shape for a furnace hearth, the actual floor of the hearth being almost level from bank to bank.* FIG. 2.—*Furnace bottom in which the base of the banks are protruding excessively, permitting heavy scrap to be piled high in the centre.* FIG. 3.—*Furnace bottom with "flat" dished too deeply, so that the scrap inclines towards the centre, causing it to bridge early in the melt.* FIG. 4.—*Furnace bottom in which the banks form shelves for the scrap.*



Maintaining the Furnace-bottom

Filling a hole in the "flat" with water and either shovelling or charging magnesite material into it has proved to be a quick and effective means of patching furnace-bottoms. Double-burnt dolomite is still the standard bottom-patching material, but is probably not as good as wet-patch materials rammed or thrown into a pool of water. Black dolomite fuses readily and is commonly used for bank patching—on bank angles of up to about 45 deg. Fine-grained black dolomite should be used on the slag-line area, where it will find anchorage and not run down on to the flat. When this occurs, however, magnesite material must either be shovelled or gunned in to give the banks proper thickness. Many US foundries make up the upper part of the banks during the melt and after about two thirds of the scrap is melted, a belt of black dolomite is either gunned or shovelled in around the entire furnace. Generally, this material slags over and after tapping very little slag-line and wall patching is required. The material can also be put in quickly from above in a bottom-pouring bucket immediately after recharging.

If metal breakout from the furnace should occur at the slag-line level and below the mast-wall section, all furnace personnel should be advised to spill the steel from the door before extensive damage occurs. For wall patching to be effective, the banks must have sufficient thickness to support the patching material and the use of water-cooled "hairpins" in tiers (Fig. 4) increases the life of the furnace lining, minimizes wall patching and gives anchorage to wet-patch materials.

A wide, shallow flat which enables heavy scrap to be melted early from the bottom upwards promotes bath melting instead of arc-flash melting. Lower bank sections which are as steep as possible allow the scrap to sink instead of roll into the rising bath. Upper sections of the banks should be maintained as thick as possible, with a contour which blends with the lining in an almost vertical line and this prevents the formation of shelves for the scrap and gives maximum protection against slag-line breakouts.

New developments in furnace-maintenance technology, such as the carbon hearth and exothermic materials are still relatively untried, but may have considerable influence on bottom practice in future.

Vacuum Degassing of 500-lb. Melts for Carbon-Steel Castings

*By D. E. Parsons**

Much additional information is required about the application of vacuum casting and vacuum

* The Author is senior scientific officer, ferrous metals section, physical metallurgy division, Mines Branch, Department of Mines and Technical Surveys, Ottawa, Canada.

degassing techniques in the production of steel castings and one objective of the series of tests described in this paper was to determine the amount of reduction in gas content obtained when 500-lb. melts of carbon, low-alloy, and austenitic steels were spray-cast into moulds, and held inside the vacuum tank, in comparison with non-degassed and ladle degassed air-poured melts.

Details of Tests

Comparison of degassed and non-degassed 0.30 per cent. carbon steel was made on test castings having sections of 1 to 4 in.—actually a 350-lb. (12 by 12 by 4-in.) slab casting, a 175-lb. step-block casting having 1, 3 and 5-in. sections, and a 50-lb. standard keel-block casting having four legs (6 by 1 by 1-in.). The criteria chosen for comparison were tensile, ductility, impact-strength and fatigue notch-sensitivity. The centre of the test-bar gauge-lengths coincided with the central axis of the 4-in. cast sections. Since the slab castings required 350 lb. of metal from 500-lb. melts, it was not possible to compare degassed and non-degassed slabs from the same melt. However, with the smaller step-block castings, each melt was split to allow pouring of degassed and non-degassed blocks and standard 1-in. section keel-block legs.

Steel melts for ladle degassing tests were usually tapped in the temperature range of 1,650 to 1,740 deg. C. into a high-walled 500-lb. capacity lip-pouring ladle, metal for these castings being tested in the silicon-killed and fully aluminium-killed conditions. After tapping, the ladle was placed inside the vacuum tank, the pumps reducing the pressure to about 15 mm. in 15 sec. A vigorous "boil" commenced which, in the silicon-killed melts was equal to the depth of the metal held in the ladle. The relatively high initial pressure of about 15 mm., fell rapidly to the 600-microns to 4-mm. range, and the duration of the ladle degassing tests was 1 to 4 min.

During ladle degassing, a temperature drop of 100 to 150 deg. C. occurred during the 5 to 8 min. period of handling and treatment. The pouring temperature for the ladle-degassed castings varied between 1,500 and 1,575 deg. C., corresponding to tapping temperatures of 1,650 and 1,740 deg. C. Most of the castings were poured into dry-sand moulds, but in one series of tests, two slab castings and two step blocks were poured into green-sand moulds (3 per cent. water by weight). Exothermic feeder-inserts were used for some tests, but no increase of feeder hydrogen content was observed for these melts in comparison with dry-sand feeders.

Results

Comparison of radiographs of non-degassed and vacuum spray-cast slices indicated a tendency to microporosity in the last-to-freeze zone at the centre of the air-cast slabs, whereas in the vacuum-cast slabs any gas porosity present was found in the ½ to 1-in. zone adjacent to the surface of the casting. It was found that the quantity of gas-porosity present increased with tapping temperature.

A summary of the hydrogen, nitrogen and oxygen contents of degassed and non-degassed metal showed that a reduction of hydrogen content of 55 to 75 per cent. was obtained; reduction of oxygen content was of the order of 60 per cent. Ladle-degassed castings maintained full-tensile ductility throughout the 4-in. section at hydrogen levels below 1.5 parts per million; vacuum-spray degassed castings had full-tensile ductility throughout the casting, provided the hydrogen content was reduced below 1.5 pp., and all the non-degassed standard castings (12 by 12 by 4-in.) gave reduced tensile ductility at the centre of the 4-in. section.

Charpy V-notch impact-bars cut from the centre of the slab castings were tested at 94, 27, 4, −18 and −40 deg. C. No change in the 15 ft.-lb. Charpy V-notch transition temperature was obtained as a result of degassing, but the improved macrostructure at the centre of the vacuum spray-cast slabs was accompanied by an increase in impact strength. Fatigue tests on un-notched and notched bars showed an increase in fatigue (notched) endurance and a decrease in the strength-reduction factor for vacuum spray-cast slabs.

Conclusions

Vacuum-spray degassing and ladle-degassing melts of 0.30 per cent. carbon steel gave final hydrogen contents of the feeder head of 1.0 to 1.5 ppm for a reduction of 50 to 75 per cent. Reduction in oxygen content by about 60 per cent. to an average final content of 33 ppm was obtained by methods of degassing. Full-tensile ductility was obtained throughout the 4-in. section test-casting by either method of degassing, providing the hydrogen content was reduced below 1.5 ppm. Non-degassed slab castings contained central porosity when poured with metal tapped above 1,600 deg. C., tensile bars from the centre of these castings giving reduced ductility and containing "fisheyes" on their fracture surfaces. It was found, however, that tempering at 204 deg. C. restored partial ductility, and full ductility was restored by normalizing and tempering of 0.505-in. bars.

It was found possible to tolerate a hydrogen content in the feeder of 4.5 ppm in the test-casting if the section was absolutely sound, but attempts to improve feeding efficiency by increasing the height of the feeder or by use of exothermic-sleeve inserts were not successful. However, with vacuum-degassed steel and a hydrogen content of less than 1.5 ppm, tapping and pouring conditions were not critical. Full-tensile ductility and a complete absence of fisheye fracture was always obtained when metal from the test melts was cast into the standard 1 by 1 by 6-in. keel-block legs; this 1-in. section was always free from porosity and did not retain hydrogen.

FURNESS SHIPBUILDING COMPANY, LIMITED, Haverton Hill, near Middlesbrough, announce they are to build a floating dock of 5,500 tons lifting capacity, for delivery this year to Centromor, a Polish Government organization.

Fifty-Eighth IBF Annual Conference

Technical Sessions and Social Events at Cheltenham, May 15 to 18

For the second time, the annual conference of the Institute of British Foundrymen is to be held at Cheltenham, the dates being May 15 to 18 inclusive. The hosts this year are the Bristol and West of England branch. Cheltenham lies between the Cotswold Hills and the Severn vale and, with its excellent shops, beautiful thoroughfares, Regency masterpieces, and gardens, offers attractions to suit all tastes. It is also a convenient centre for visits to the many interesting foundries in the branch area. A new departure this year is the permitting of members to attend any of the ladies' excursions.

Conference Office. The Conference Office will be established on May 15 at the Town Hall, Cheltenham. Communications prior to this date should be addressed to the Institute's head office at 14, Pall Mall, London, S.W.1.

Programme

Brief particulars of the general programme are as follow:

Monday, May 15

Afternoon: Council and committee meetings at the Queen's Hotel, Cheltenham.

8.30 to 11.30 p.m.: Reception by His Worship the Mayor and the Mayoress of Cheltenham in the Pittville Pump Room, Cheltenham.

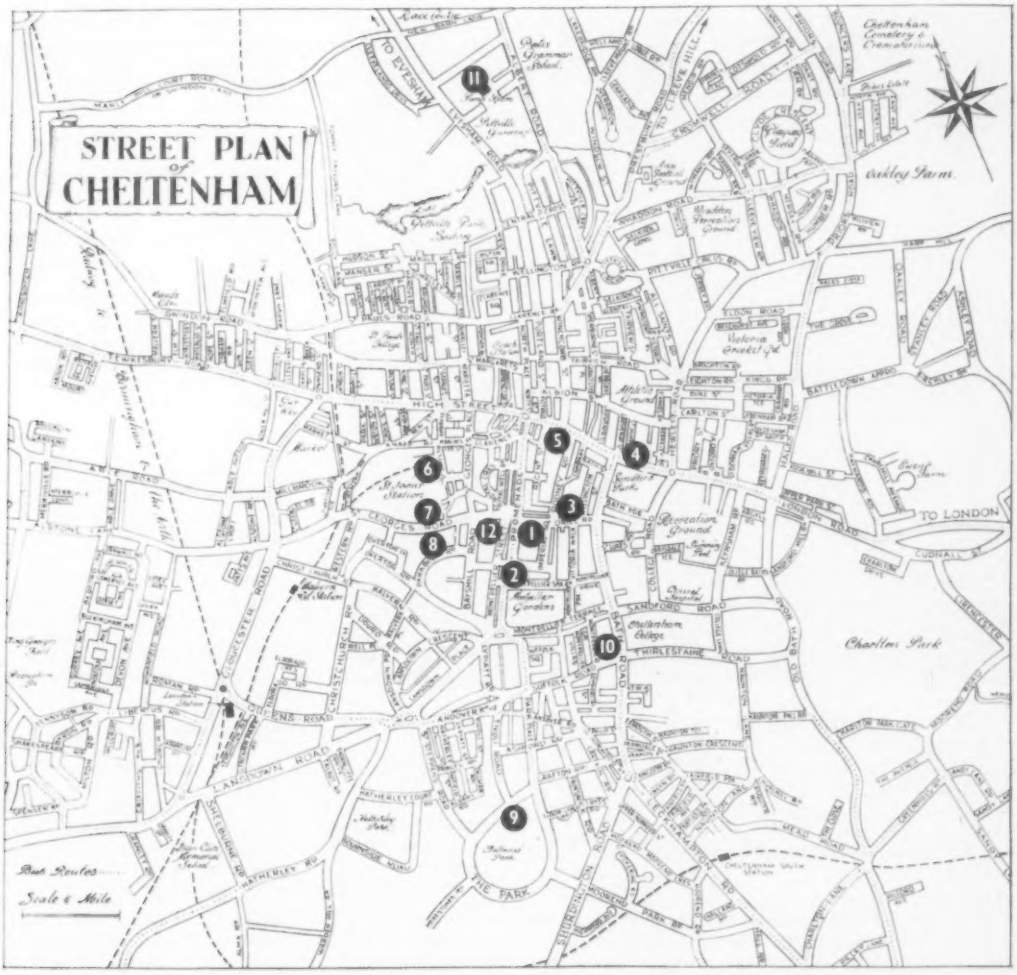
Tuesday, May 16

9.15 a.m.: Annual general meeting of members and presentation of awards in the Pillar Room, Town Hall, Cheltenham.

11 a.m.: Presidential address by Mr. D. A. Richards.

11.30 a.m.: Edward Williams Lecture entitled

General aerial view of the centre of Cheltenham Spa, showing particularly the Town Hall and its immediate surroundings (see line plan for Key).



Line plan of Cheltenham Spa to assist in selecting hotels in relation to Conference meeting places, etc.

KEY: (1) Town Hall (Conference meetings, banquet, and dinner/dance); (2) Queens Hotel; (3) Ellenborough Hotel; (4) Belle Vue Hotel; (5) Plough Hotel; (6) St. James' Station; (7) George Hotel; (8) Carlton Hotel; (9) Majestic Hotel; (10) Irving Hotel; (11) Pittville Pump Room (Civic reception), and (12) Ladies' College.

"Leadership in Management," by Mr. N. P. Newman, C.B.E., J.P.

12 a.m.: Conference adjourns for luncheon, 12.45 p.m. for 1 p.m., in the Large Hall of the Town Hall, Cheltenham.

2.30 p.m.: Conference recommences with technical sessions at the Town Hall.

7 p.m.: Reception at the Town Hall by the president and Mrs. Richards, followed at 7.30 by the annual banquet and dancing until 1 a.m.

Wednesday, May 17

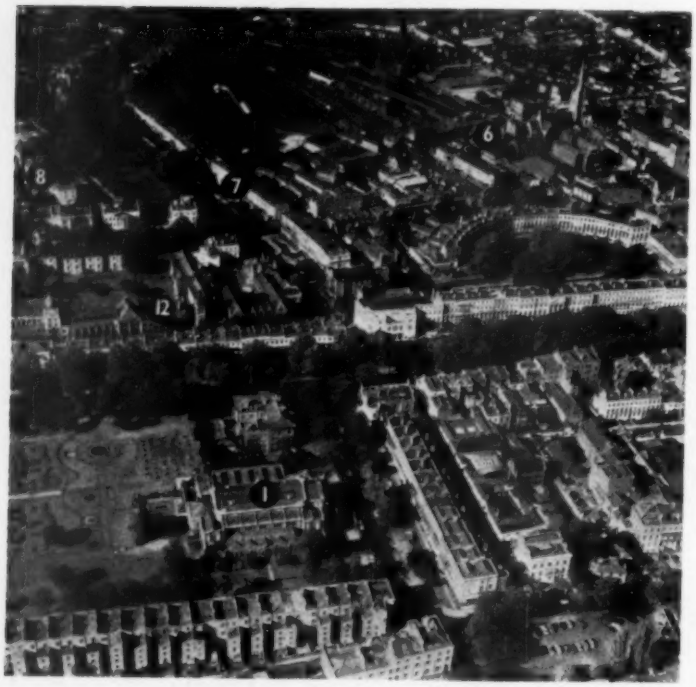
Members will take part in *one* only of the following visits or groups of visits, departing by coach from the Town Hall, and returning to Cheltenham at about 6 p.m.

8.45 a.m.: (1) Morning: (*a*) Stothert & Pitt, Limited, Bath, and afternoon (*b*) Douglas Kingswood, Limited, Bristol.

9 a.m.: (2) Morning (*a*) Newman Industries, Limited, Yate, Bristol, and afternoon (*b*) Gloucester Foundry, Limited, Gloucester.

9 a.m.: (3) Morning: (a) Westinghouse Brake & Signal Company, Limited, Chippenham, and afternoon (*b*) British Railways Foundries, Swindon.

9.10 a.m.: (4) Morning (*a*) National Smelting Company, Limited, Avonmouth, and afternoon (*b*) Brecknell, Dolman & Rogers, Limited, Bristol.



Aerial view of Cheltenham Spa, showing the relative positions of the Ladies' College, Town Hall and Spa (for key see line plan).

9.20 a.m. (5) All-day visit to Bristol Siddeley Engines, Limited, Bristol.

9.30 a.m. (6) Morning (*a*) Newman, Hender & Company, Limited, and afternoon (*b*) R. A. Lister & Company, Limited, both firms being in Gloucester.

7.45 p.m.: Visit to the Everyman Theatre, Cheltenham.

Thursday, May 18

The whole day will be devoted to technical sessions, followed in the evening with a dinner, dance and cabaret in the Large Hall, Town Hall, Cheltenham.

Ladies' Programme

Tuesday, May 16

10.30 a.m. Coaches leave the Town Hall, Cheltenham, for a millinery display by Aage Tharrup at the Pittville Pump Room, Cheltenham, return to Town Hall for luncheon.

3.15 p.m. Furs and boutique display by Maxwell Croft, Limited, at the Queen's Hotel, Cheltenham. (Evening programme as for members.)

Wednesday, May 17

Ladies may participate in *one* only of the following visits:—10.30 a.m.: (1) Tour of the Cotswolds followed by visit to Strachan & Company, Limited, clothmakers, Stroud, returning to Cheltenham about 5.30 p.m.

10.45 a.m.: (2) Visit to Gloucester Cathedral in the morning and Berkeley Castle in the afternoon, return to Cheltenham about 5.30 p.m.

10.45 a.m. (3) Visit to Bath including Roman Baths, Pump Room and Abbey, returning to Cheltenham about 6 p.m.

2 p.m.: (4) Visit to Prinknash Abbey and Monastery where pottery is made; arrive back in Cheltenham about 5 p.m. (Evening programme as for members.)

Thursday, May 18

Leave by coach for *one* only of the following visits:—10.30 a.m. (1) Visit to Blenheim Palace, return Cheltenham about 6.15 p.m.

11 a.m. (2) Tour of North Cotswolds and visit to Snowshill Manor; returning to Cheltenham about 4.15 p.m. (Evening programme as for members.)

Technical Sessions

Tuesday, May 16

2.30 to 5 p.m.: Two simultaneous sessions.

Session A. (Pillar Room, Town Hall, Cheltenham) Paper No. 1., Report of sub-committee TS49 —"An Evaluation of Feeding Heads and Feeding Aids for Castings". No. 2, "Thoughts on Phosphoric Cast Iron," by R. V. Riley, PH.D., B.SC., F.I.M. No. 3, "Practical Observations on Mould Stability as a Factor in Controlling Soundness," by A. D. Morgan and J. M. Greenhill.

Session B. (Drawing Room, Town Hall) Paper No. 4, "Casting Nickel-base Alloys from Investment Refractory Shells and Vacuum Furnaces," by D. F. B. Tedds, F.I.M. No. 5, "Structure and Properties of Sand-cast Gunmetals," by J. E. Stolarczyk, A.C.T.(BATT.)A.I.M. No. 6, "Shell Moulding and its Application to Copper-base Alloys," by G. W. Brown, A.I.M.

Thursday, May 18

9.30 a.m. to 12.30 p.m.: Two simultaneous technical sessions.

Session C. (Pillar Room, Town Hall) Paper No. 7, "Plant Maintenance," by R. E. J. Roberts. No. 8, "Planning a General Iron Foundry," by E. Longden, M.I.MECH.E. No. 9, Report of sub-committee TS52—Melting Furnaces.

Session D. (Drawing Room, Town Hall) Paper No. 10, "New Developments in the Founding of Gunmetal Castings," by F. Hudson, F.I.M. No. 11, "Influence of Bismuth, Iron, Arsenic, and Antimony in Sand-cast Gunmetals," by J. E. Stolarczyk and D. A. Hudson, B.SC., A.R.S.M., and D. Ashbolt.

No. 12, "Gravity Die-casting," by D. Redfern and Mrs. I. E. Brown, A.I.M.

2.30 to 5 p.m.: Two simultaneous sessions.

Session E. (Pillar Room, Town Hall) Paper No. 13, "Heat-treatment of Grey-iron Castings," by W. M. Lord, B.SC.(TECH.), A.I.M. No. 14, "Impact Testing of Cast Iron," by G. N. J. Gilbert, A.M.I.MECH.E., A.I.M. No. 15, "Removal of Trace Elements from Cast Iron using Oxidation Processes," by R. H. T. Dixon, A.I.M., A.C.T.(BIRM.).

Session F. (Drawing Room, Town Hall) Paper No. 16, "What to Expect from Vacuum Die-casting," by F. C. Bennett (AFS sponsored paper). No. 17, "Developments in Pressure-die-casting Machinery for Aluminium," by E. Gaspar, M.I.MECH.E., and M. G. Munns, A.M.I.MECH.E. No. 18, "Relative Chilling Powers of Various Mould Materials with Aluminium and its Alloys as Test Castings," by A. Ramachandran, B.E., M.S., PH.D., and M. R. Seshandri.

Hotel Accommodation

With regard to accommodation, it is pointed out, that as in Malvern last year, Cheltenham lacks large hotels, and members must necessarily be dispersed amongst a number of small hotels. All requiring accommodation locally are requested to make their own bookings direct with the hotel of their choice (a list is available from the Institute) at the earliest possible moment, and in any case not later than April 15. The latest date for receiving conference reply forms (at the London office of the Institute) is also April 15.

Company News

Wellman Smith Owen/Incandescent Heat Bid

A bid worth £1,330,000 has been made by the Wellman Smith Owen Engineering Corporation, Limited, for the Incandescent Heat Company, Limited, founders and furnace and foundry-equipment manufacturers, of Smethwick, Birmingham. The offer is 129s. cash or one 5s. Wellman ordinary share plus 84s. cash for every four of Incandescent Heat's 824,895 ordinary 4s. shares. The directors of Incandescent Heat, who own more than 40 per cent. of the shares, recommend acceptance.

The new Wellman shares will rank for the final dividend for the year ending March 31, 1961, which the directors expect will not be less than 15 per cent., the same as last year. The business of Incandescent Heat is largely complementary to that of Wellman Smith Owen and covers a wide range of thermal engineering throughout the metallurgical, chemical, foundry, and other industries.

The merger will broaden the field of activities of both companies, it is stated, and enable them to offer the combined technical research, development, and manufacturing facilities of the new group throughout the entire field of furnace design and construction. It is intended that Incandescent Heat shall continue to operate as an autonomous unit.

If the offer becomes unconditional, Mr. John Fallon, chairman of the Incandescent group, will be invited to join the Wellman board, and Sir Peter Roberts, chairman of the Wellman group, will be invited to accept office as vice-chairman of the Incandescent group. Wellman Smith Owen will require to increase its share capital to implement the offer and for this purpose an extra-ordinary meeting is being convened.

CAPE ASBESTOS COMPANY, LIMITED—The outstanding ordinary shares in Small & Parkes, Limited, are to be acquired compulsorily.

GEORGE COHEN (EAST AFRICA), LIMITED—one of the 600 group of companies—have purchased the entire plant and machinery, steel-framed buildings, etc., of URUWIRA Minerals, Limited, who until last October, were mining lead, copper and silver at Mpanda, Tanganyika.

BOULTON PAUL AIRCRAFT, LIMITED—All the capital of Accurate Screw Threads, Limited, Hednesford (Staffs), has been acquired from the Sheffield Twist Drill & Steel Company, Limited. Last month the Dowty Group, Limited, made an offer for the ordinary capital of Boulton Paul Aircraft.

I. L. BERRIDGE & COMPANY, LIMITED—The acquisition of the company by Alfred Herbert, Limited, has been completed. The subsidiary and associated companies, together with the Whetstone factory have, as agreed, been sold to C. S. Martin (Holdings), Limited, and C. S. Martin, Limited.

B.T.R. INDUSTRIES, LIMITED—Group sales for the first three months of the current year are well up on those for the corresponding period of last year, although sales have fallen short of expectations in some sections. Profits, before tax, for the year ended October 1, 1960, were £893,878 (£579,135). Demand by the National Coal Board for PVC fire-resistant belting continued to be substantial. The sales of rubber belting increased by about 20 per cent., reflecting the increased activity of the capital equipment industries.

EXPERT TOOL & CASE HARDENING COMPANY, LIMITED —Cash offer of 2s. 9d. for each of the 2s. shares has been made by the Northern Mercantile & Investment Corporation, Limited. The directors have recommended acceptance. If the bid gains 90 per cent. acceptance, the purchasers will pay the arrears of the preference dividend from July 1, 1958, and will continue the business of the group. Mr. Sydney Newman and Mr. Raymund Ball have agreed to resign from the board. Mr. Angus Murray and Mr. W. G. F. Westbrooke will continue as directors.

ASSOCIATED COMMERCIAL VEHICLES, LIMITED—The whole of the issued share capital of 750,000 £1 ordinary shares of Transport Equipment (Thornycroft), Limited, is to be acquired. The company is a wholly-owned subsidiary of John I. Thornycroft, Limited, shipbuilders and repairers, and iron and brass founders, etc., of London, S.W.1, and comprises of all that group's road transport and automotive diesel-engine manufacturing and selling interests. The consideration is 150,000 fully paid £1 ordinary ACV £1 shares, ranking *pari passu* with the present share capital, and £1,000,000 in cash to be paid over two years.

BAKER PERKINS, LIMITED, manufacturing engineers and iron and non-ferrous founders, of Peterborough—To re-finance the purchase of a number of businesses during the past year a rights issue of 871,296 £1 ordinary shares at 36s. each is to be made on the basis of seven shares for every £25 ordinary stock held on January 24. The issue is expected to raise £3,000,000. The directors expect to recommend a final dividend of 8¼ per cent. on the present capital making 11¼ (8) per cent. for 1960, against a forecast of 10 per cent. The offer for Rose Bros. (Gainsborough), Limited, has now been accepted in respect of the whole of the capital.

Equipment & Supplies

Hydraulic Fettling Clamp

Power Jacks, Limited, Acton, London, W.3 (American subsidiary: Newton Tooling Ltc., USA) have developed an automatic hydraulic device called the Newton swing clamp which can be applied to hold castings on a bench while fettling—drilling, grinding, etc. As its name implies, the unit has a swinging-arm action and in the "off" position, the clamping arm is lying at right angles to the work, giving ample room for positioning and unloading. At the touch of a lever, the arm swings in over the work and is tilted by a hydraulic plunger to apply pressure, the combined movement being completely automatic. When released the arm swings back to the start position.

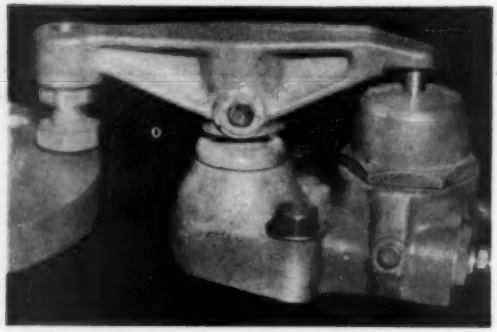


FIG. 1.—*Newton hydraulic swing-clamp in operation for holding a flanged casting (left).*

The unit (Fig. 1) may be used singly or in series: installation is claimed to be simple, and the small size of the device (7 by 3½ in. with a maximum clamping force of 1,160 lb.) said to be of great advantage where space is limited. The firm operate a free advisory service for guidance on hydraulic clamping.

Vibratory Screens

A new range of heavy-duty screens has been developed by the Sinex Engineering Company, Limited, of North Feltham Trading Estate, Feltham, Middlesex. These incorporate a rotary electric vibrator as a power unit, and are applied for such plant as hopper grids and vibratory chutes, grizzlies and bunker clearance equipment. Standard sizes are 4 by 3, 6 by 3, 8 by 4 and 10 by 4 ft; the screens can be fitted with profiled meshes or fabricated screening decks. The vibrators are fitted with adjustable amplitude weights. Screens can be used with vibratory chutes and inter-locked with bunker vibrators to serve as feeders from bulk-storage hoppers.

Ferro-alloy Briquettes

Union Carbide, Limited, Alloys Division, from 8, Grafton Street, London, W.1, announce that from March 6 ferro-alloy briquettes will be marketed in a new shape and with new packaging—the result of adopting production equipment designed to provide uniform size, weight, texture and quality of briquettes. At the same time, the company state they are able to reduce the cost of briquettes to all users. It is emphasized that no change in melting practice is necessary when using the new briquettes: each is identified by the same colour code.

To permit manufacturing economy, manufacture of the "one-pound alloy" briquettes has been discontinued in favour of a standard unit to contain the equivalent of two pounds of the addition element. However, the new briquettes have a "V" notch in the centre which enables them to be split evenly into "one-pound alloy" halves. The new product will be despatched in bundles with a nett weight of 60 lb. for silicon and zirconium/silicon, 56 lb. for manganese and chromium, and 52 lb. for silico-manganese briquettes. Deliveries of up to 5 cwt. will be by loose bundles, but larger amounts will have the bundles on non-returnable pallets.

Finally, as a result of research into the ferro-silicon usage in foundries the firm believe that over 80 per cent. of the briquettes used are 45/50 per cent. grade: they have therefore decided only to manufacture this grade of silicon addition alloy, a factor which has contributed to the price reduction.

Diesel/Electric Crane: An interesting example of co-operation between user and manufacturer lies behind an order by Stewarts and Lloyds, Limited, of Corby, Northants, for a seven-ton diesel/electric travelling crane, to be made by Thomas Smith & Sons (Rodley), Limited, Town Street, Rodley, Leeds. The crane is primarily required for use inside buildings for clearing pits, and when thus employed the crane will be static. However, the problem of coping with fumes which would be given off by a stationary diesel engine in an enclosed area led the builders to equip the crane so that it may be operated when inside the building directly from the mains electricity supply. The diesel drive will only be employed when greater mobility is required on duties outside.

Curing Agents for Resins: Shell Chemical Company, Limited, announce the addition of two new products, "Epikure" RTH and accelerator RTA, to their range of curing agents for liquid "Epikote" resins, which find extensive uses in the engineering and electrical industries. "Epikure" RTH is a low-viscosity, room-temperature curing agent, which has been specially developed for use with "Epikotes" 828 and 815. A feature of the new agent is that it may be used with varying proportions of accelerator RTA for the production of both "castings" and glass-fibre-reinforced laminates which, it is claimed, have excellent mechanical properties and resistance to chemicals.

Cable Sheathing: Cables clad in a new material made from a blend of Geon PVC and Hycar nitrile rubber are now being produced by Greengate & Irwell Rubber Company, Limited, for the sheathing of trailing cables, hoist cables and flexible power cables, such as for supplying power to foundry lifting magnets. It is claimed the nitrile-based sheathing withstands temperatures up to 85 deg. C. and has good mechanical properties, good oil, solvent and fire resistance and excellent abrasion resistance. Geon PVC and Hycar nitrile rubber are made by British Geon Limited, (Devonshire House, Piccadilly, London, W.1) a company in the Distillers' plastics group.

PRICE REDUCTIONS ranging from 10 to 20 per cent., which affect a number of their products, are announced by the Kenilworth Manufacturing Company, Limited, (West Drayton, Middlesex). They have been made possible by a recent fall in resin prices and lowered production costs. The reductions apply to a range of epoxy formulations used as adhesives and to some tooling compounds.

Twenty-one Years' Association celebrated

To mark 21 years' association with David Brown Tractors, Limited, through the supply of castings, Repton Foundry, Limited, of Tividale, Tipton, Staffs, were recently hosts to David Brown executives at a dinner held at the George Hotel, Huddersfield. Mr. E. C. Marsland, managing director of Repton Foundry Limited, referred to the happy association between the two companies throughout the 21 years of David Brown tractor production at the Meltham (Huddersfield) factory and Mr. David Brown junior (joint managing director) replied on behalf of the guests.

The photograph shows (left to right) Mr. David Brown junior, Mr. E. C. Marsland and Mr. J. Thompson (general manager, David Brown Tractors, Limited), during the dinner.

BISRA "Open Days"

The British Iron and Steel Research Association will hold two "Open Days" at its Sheffield laboratories, in Hoyle Street, on Thursday and Friday, June 15 and 16. Since the last "open house" was held (in 1956), many developments have taken place, and visitors will find much to interest them.

The Hoyle Street premises house three of BISRA's five main divisions—steelmaking, metallurgy (general) and the mechanical working division. The steel user section, which operates an important advisory service to industry generally, is also housed there.

Among the many displays and demonstrations planned by the steelmaking division will be the latest developments in continuous casting, and work on spray refining and rapid de-sulphurization. One of the mechanical working division's projects on show will be a recently-developed rapid-annealing system. Prominent among the metallurgy division's projects will be aspects of its general pre-occupation with the purification of steel (jet de-gassing, vacuum casting, etc.), work on improved speed and accuracy in analysis, and the production of steels to resist high-temperatures. Many other projects will also be on show.

Mr. D. L. CAMPBELL has resigned from the board of Wellman Smith Owen Engineering Corporation, Limited.

EEC Apprentice Training

Over 300 apprentices received prizes worth more than £1,500 at the 19th annual apprentice presentations of the English Electric Company, Limited, held at Phoenix Works, Thornbury, Bradford, on February 4. Mr. J. Parker, general manager, who presided, referred to the need for skilled people—a problem which was concerning Government, industry and the public alike. At Bradford, he thought the company was making an important contribution to the pool of skilled labour in the area, by its apprentice schemes and other training for which the company was prepared to invest some £125,000.

Mr. J. F. M. Doogan, warden of Brathay Hall Trust, Ambleside, presenting the awards, said it was an age of challenge; it was going to "take everything they had," and it called for good, clear, and original thinking. The Bourne Cup for the best all-round technician of the year, went to Mr. R. B. Dutton, and Mr. J. C. Moody was presented with the Foremen's Shield for the best apprentice of the year for the second year in succession. Both received fifth-year awards.

Training Schemes

In presenting the annual education report, Mr. J. Moon, chief of personnel and education, said that where suitable arrangements could be made, block-release schemes were favoured by the company. During 1960, with the co-operation of Bradford Technical College, the first four block-schemes of full-time training had been entered into, and this year 161 apprentices would be attending the College on a full-time basis for at least three months. Bradford College was one of the two in the country running a full-time City and Guilds course in machine-shop engineering, the other was at Rugby. Bradford College, however, had the only course of its kind in the country, by which as students finished one course a similar number started a fresh one.

Finally, Mr. Moon referred to the position of girls in the engineering industry and the possibility of technical jobs for them. Although, he said, it was clear that girls were capable of coping with technical work, especially in laboratories, the company was not at present anticipating offering technical apprenticeships to girls. They could see, however, definite opportunities for giving them more interesting work and granting them time off to study for appropriate technical qualifications.

Armstrong Whitworth's New Roll Foundry

Mr. Reginald Maudling, President of the Board of Trade, officially opened on February 10, the rebuilt and enlarged heavy-roll foundry bay of Armstrong Whitworth (Metal Industries), Limited, Close Works, Gateshead on Tyne, 8. The bay, 220 ft. long and 55 ft. wide, has been designed for producing rolls with a maximum cast weight of up to 55 tons, and since its completion the company has increased its roll-production capacity by approximately 2,500 tons a year.

Reconstruction of the bay is the latest stage in Armstrong Whitworth's programme for the expansion of roll production to meet growing demands of the steel industry. The company has already brought into operation, in a recently built shop, two heavy-duty lathes, a vertical borer and a horizontal miller, and are shortly to instal a high-precision roll-grinding machine. About a third of the company's roll production is exported.

News in Brief

D. ROBINSON & COMPANY, LIMITED, are removing on February 27 from Hounslow to 5 to 7, Church Road, Richmond, Surrey.

THE NEWCASTLE BRANCH of Wolf Electric Tools, Limited, has moved into new and larger premises at 94-96, Heaton Road.

GREEK TOBACCO worth £40,000 is to be shipped to Britain in exchange for bus chassis made by Guy Motors, Limited, of Wolverhampton.

A BOOKS FOR INDUSTRY EXHIBITION is to be opened at the Engineering Centre, Birmingham, on March 4, by Dr. P. F. R. Venables, principal of the College of Advanced Technology, Birmingham.

A STATEMENT appearing in a *Bulletin*, issued by the Foundry Trades' Equipment and Supplies Association, covering a trade enquiry is to the effect that there are 800 foundries operating in Argentina.

M. COCKBURN & COMPANY, LIMITED, are to extend their foundry premises at Abbots Works, Falkirk, by erecting a building to house a boilerhouse, acid neutralizing and settling tanks, and office accommodation. Estimated cost of the work is £10,000.

THE FOURTH ANNUAL LECTURE of the Institute of Welding 54, Princes Gate, Exhibition Road, London, S.W.7, will be given on April 24 or 25, at 7.30 p.m. by Dr. N. P. Inglis, on the subject of "Welding in the Non-Ferrous Field." (Admission will be by ticket only.)

ISAAC BRAITHWAITE & COMPANY (ENGINEERS), LIMITED, Kendal, have sent a £10,000 washing machine to Moscow for display at the British Trade Fair. For 11 hours a day for 17 days the machine will be washing "dirty linen in public" at the rate of 300 lb. per hour.

ONE MAN WAS KILLED and another injured in an explosion in a blast-furnace at Carron Works, Falkirk, on February 2. The man who died was Mr. Keenan, assistant charger, and the injured man is Mr. W. Donaldson, who was removed to hospital with extensive burns.

DAMAGE estimated at several thousand pounds was caused by a fire during the night of February 1 which gutted the top two storeys of an engineering and maintenance building at Newall's precision foundry at Prettywood, Heywood (Lancs). It is expected that production will not be affected.

GENERAL ELECTRIC COMPANY, LIMITED, Magnet House, Kingsway, London, W.C.2, has installed at the Clydebridge Steelworks of Colvilles, Limited, at Cambuslang, an infra-red plant for drying stoppers for their 90- to 150-ton ladles. This is another ancillary process which has been rationalized.

BECAUSE OF A RECESSION in hardware goods, 400 employees at the Falkirk factory of R. & A. Main, Limited, are to start a four-day week. It is reported to be a temporary measure, and it is expected the firm will be back to full-time working in about a month. Maintenance staff and office workers are unaffected.

K. & L. STEELFOUNDERS & ENGINEERS, LIMITED, of Letchworth (Herts), are to send a 30-ton Jones KL 12-20 lorry-mounted crane by road to the Leipzig Spring Fair opening on March 5. The crane, never before seen in East Europe, will be shipped from Hull to Bremen, and then driven about 450 miles to Leipzig.

SYDNEY FLAVELL & COMPANY, LIMITED, Leamington, report substantial orders already received for their new automatic cooker. At present 300 of the company's 1,000 employees are working a four-day week, but with the marketing of the new product it is hoped that the situation will quickly change for the better.

SPEAKERS AT A SHEFFIELD CONFERENCE on further education, entitled "The Image of the Sixties," arranged by the Sheffield Schoolmasters' Association on March 4, include Councillor R. Viner, president of the Cutlery Manufacturers' Association, and Mr. H. Parkin, chief education officer to the English Steel Corporation, Limited.

BRITAIN'S TRADE with China last year reached the record level of £57,000,000, compared with £7,500,000 in 1952 and £27,000,000 in 1957. China bought from Britain nearly £6,000,000 worth of iron and steel, and over £3,750,000 worth of electric and other machinery. Value of tractors sent to China from the UK since 1956 has reached nearly £2,500,000.

EXPANSION OF THEIR FACTORY at East Kilbride, near Glasgow, is planned by Rolls-Royce, Limited, to permit growth and development of experimental departments. The Scottish factory is responsible for the manufacture and overhaul of Avon civil and military jet engines. The development will mean that jobs for another 200 men will be available.

IN CONNECTION with reconstruction of their foundries at Whifflet, near Airdrie, Lanarkshire, R. B. Tennent, Limited, have placed engineering works contracts, to the value of £166,000, with the Lanarkshire firm of William Bain & Company, Limited. The work includes construction of a tackle storage bay, extension of the furnace bay, a scrap yard and heat-treatment shop.

W. H. DORMAN & COMPANY, LIMITED, diesel-engine manufacturers of Stafford, have signed a 20-years agreement with Fairbanks-Morse & Company, of Chicago, to sell British diesel engines throughout the United States. By the agreement Dormans expect to earn $5,000,000 a year within three years; total earnings for 1961 alone, it is stated, will exceed $1,000,000.

SECOND BATTERY of 26 coke ovens at the new works at Greatham, near West Hartlepool, of the South Durham Steel & Iron Company, Limited, was started up recently by Mr. T. J. Williams, a director and general manager. The first battery of ovens started in July, and a third is nearing completion which will bring the total number of ovens in operation up to 78.

THE FRENCH AUTOMOBILE MANUFACTURERS, Simca, of Nanterre, recently set up a sales organization in Western Germany under the name of Deutsche Simca Vertriebsges G.m.b.H., controlled by NSU-Motorenwerke AG, Neckarsulm. Simca is France's second largest motor-car producer, employing over 30,000. The company produced 262,000 vehicles in 1959.

SOCIAL SERVICE OR COMMERCIAL ENTERPRISE, was the theme of Mr. R. C. Hilton, divisional traffic manager of the Western Region, British Railways, when he addressed the Non-Ferrous Club luncheon meeting at the Queen's Hotel, Birmingham on February 1. At this meeting, a collection taken on behalf of the Royal Metal Trades Pension and Benevolent Society, realized the sum of £18 8s. 9d.

THERE WERE MORE than 300 executives from Sheffield industries at a film show staged by the Sheffield branch of the Incorporated Sales Managers' Association at the canteen of the Sheffield Twist Drill & Steel Company, Limited, on February 1. The films, shown by the American trainers of salesmen, Mr. Dick Borden and Professor Alvin C. Busse, set out methods and techniques of salesmanship.

MIDLOTHIAN COUNTY COUNCIL have prepared final plans to build Esk Valley College for technical education at an estimated cost of £550,000. It will be

built on a 13-acre site at Lugton, Dalkeith, on the Duke of Buccleuch's estate. Building begins in March next year and should end by September, 1965. About 2,000 day students and 1,200 evening-class students are expected to attend the College.

LANCASHIRE DYNAMO ELECTRONIC PRODUCTS, LIMITED, Rugeley (Staffs), a Metal Industries group subsidiary, has concluded a licence agreement with the Emerson Electric Manufacturing Company of St. Louis, Missouri, under which the American company will have the right to manufacture on a royalty basis the complete range of Lancashire Dynamo electronic-control equipment developed over the past 15 years.

THE FORMATION of an Institute of Corrosion and the classification of workers in the corrosion field into research workers, specialists and general practitioners were suggestions made by Mr. C. L. Wilson at the second annual dinner of the British Association of Corrosion Engineers, held at the Waldorf Hotel, London, last month. He spoke of corrosion as a disease of industry and said it should be attacked as the medical profession attacks disease.

DAVY & UNITED ENGINEERING COMPANY, LIMITED, a member of the Davy-Ashmore group, have secured a contract to build a 32 in. and 57 in. by 98 in. 4-high reversing hot breaking down and plate finishing mill for the works at Chippis, in Switzerland, of A.I.A.G., Aluminium-Industrie-Aktien-Gesellschaft. The mill will be capable of producing aluminium plate up to 7 ft. 6 in. wide and down to ¼ in. minimum thickness. The value of the contract exceeds £500,000.

MR. J. H. REED, managing director, Ericsson Telephones, Limited, Beeston, Nottinghamshire, has announced plans for a new £60,000 training section, which it is hoped will be completed by September. It will improve facilities in the fitting and electrical workshops, create opportunities for more advanced electronics' study and provide extra lecture rooms, library and museum space. Mr. Reed also stated that the average cost of training each student is about £3,000.

THE ROYAL SOCIETY OF ARTS announces two lectures on the steel industry. The first is by Sir Andrew McCance, D.L., D.SC., LL.D., F.R.S., on "Technical Developments in the Steel Industry," at 6 p.m., on March 8. Sir Robert Shone, C.B.E., gives the second lecture on March 22 at 6 p.m., his subject being "Economic and Commercial Aspects of the Steel Industry." Applications for tickets should be addressed to the secretary of the Society, John Adam Street, Adelphi, London, W.C.2.

RUSTON & HORNSBY, LIMITED, and their associate company, Davey, Paxman & Company, Limited, have secured a contract to supply all the diesel power for a new manganese mine nearing completion in the New Hebrides, the group of islands in the South Pacific administered by a British-French condominium. The two British firms will also supply the engines required for the launches and tugs which will be employed in the harbour under construction for shipment of the manganese. The order is worth more than £80,000.

PLANS COSTING £1,100,000 will boost Australian production of naphthalene and phthalic anhydride, announces the Broken Hill Proprietary Company, Limited, and the Imperial Chemical Industries, Limited. Broken Hill is installing plant costing over £500,000 to process tars derived from coke oven operations at Port Kembla for the recovery of naphthalene. Jointly owned by the ICI and Broken Hill, the Newcastle Chemical Company, Limited, is doubling the capacity of its phthalic anhydride plant at a cost of about £600,000.

NEW ORDERS received by Dartmouth Auto Castings, Limited, of Smethwick, for castings for tractors, commercial vehicles and diesels, has enabled the company to recommence night-shift work for about 60 employees. This is the result of the company's decision, when a recession in the motor industry seemed likely a few months ago, to seek new orders mainly in the commercial-vehicle industry. The foundry is now working at full capacity, and the company is going ahead with the £600,000 expansion programme announced some months ago.

MR. JOHN BELL, senior partner in the firm of Albert Smith & Company, Scottish agents for Sterling Foundry Specialities, Limited, London Road, Bedford, was a guest at the second annual dinner/dance of the company, held at the Dujon Restaurant, Bedford. In proposing the toast to the company he said a big business to be successful needed continuity of personnel in their works, good technical and planning staff and executives who lived in the present but remembered the past and thought of the future. Mr. Victor Brackenbury, a director, who replied to the toast, recalled that the price for the first order dealt with in March, 1923, was now only just doubled in spite of the lapse of 37 years.

MEETINGS DURING FEBRUARY announced by the Combustion Engineering Association are as follow: Southern region, on February 21, a discussion on "Problems of the Packaged Boiler," to be opened by Mr. A. Wilson (Unilever, Limited), commencing 10.30 a.m. at the Criterion Restaurant, Piccadilly Circus, London, W.1. On February 22, a meeting of the Midland region will be held at the Birmingham Exchange and Engineering Centre, on the subject of "Preparation and Handling of Coal and Ash in Small Boiler Plant." Mr. E. Otty, of the National Coal Board, will talk on coal preparation and Mr. W. G. Archer, Babcock & Wilcox, Limited, will deal with coal and ash handling. The meeting commences at 10.30 a.m. A North Western region meeting will be held on February 28, commencing 7.15 p.m., at the Engineers' Club Albert Square, Manchester, when Mr. A. F. A. Nida, Shell Mex & B.P. Limited, will be speaking on "Fuels for Modern Engines."

Death of Sir Arthur Croft

Sir Arthur Croft, chairman of Crofts Engineers (Holdings), Limited, died at his home, Buckstone Hall, Rawdon, near Leeds, on February 12 at the age of 74. He was educated at Hanson Grammar School, Bradford, and joined the family foundry and engineering concern as an apprentice (just 16 years after it had been founded by his father on £50 capital). When the firm started in 1887, only seven people were employed, now it is one of the largest manufacturers of power-transmission machinery in the country, with the main plant at Thornbury, Bradford, and subsidiaries in Canada and South Africa. Sir Arthur became one of its directors when it was made a private limited company in 1907; on the death of his father 13 years later he was made joint chairman and in 1936, governing director. In 1948, the public company was incorporated, and he became chairman and managing director, but retired from the latter post in 1953 after completing 50 years' service, his son succeeding him. Sir Arthur (who was knighted in 1953) took a great interest in the provision of amenities, and apart from providing a sports field and recreation hall, he also introduced superannuation, insurance and bonus schemes for his workpeople in advance of his contemporaries.

American Letter

1961 US Labour Situation

With the US foundry industry running about 25 to 35 per cent. under par, the growing threat of increasing unemployment (not much discussed during the Presidential campaign!) is being brought forward now. The manufacturing trades are carrying the larger share of the unemployment burden and other activities are less affected. Business during 1960 has not provided enough new employment opportunities to absorb the growth in the US labour force. During 1960, unemployment averaged 5.1 per cent. during the first half of the year, rose to 5.7 per cent. in the third quarter, and reached 6.4 per cent. in October—the highest rate since late 1958. Statistics showed that the number of unemployed at September, 1958, was 4,700,000 as compared with 3,400,000 at September, 1959. The number of employed at September, 1958, was 65,370,000 as compared with 67,240,000 at September, 1959.

The new administration in the US is likely to find more than 5 million unemployed and an increasing share of them unemployed for 15 weeks or more as it moves into the first quarter of 1961. This seasonal peak is normally followed during the spring months by a decline in unemployment. The statistical position to date is:—

	Jan. 1959	Jan. 1960	Dec. 1960
US employed ..	64,700,000	65,600,000	67,200,000
US unemployed ..	3,800,000	3,700,000	4,030,000

The new US Secretary of Labour will be a former official of the Steel Workers' Union and his immediate problem will be to lessen the unemployment rate, which is climbing up towards 7 per cent.; surveys of depressed areas by the leaders of the incoming administration are already under way.

Among the factors cited as contributing to the US unemployment problem is the increasing amount of foreign imports. Sometimes the expression is heard that "US labour has priced the goods it makes out of the international market," and, at other times, "it is the favourable climate for the manufacture of US export goods in foreign factories." This possibility led to a survey which compares the effect of "fringe" benefits on top of basic wages in the US and Europe.

"Fringe" Benefits

Within the past 25 years, "fringes" have become major elements of labour expense. US firms setting up branches abroad have discovered that non-wage benefits can often run total employment costs far above the expense of basic wages. Tables 1 and 2 (taken from the December letter of the First National City Bank of New York) shows "fringe" benefits as a percentage of hourly wage rates in a number of countries.

In Canada, fringe costs are also climbing and now average about 16 per cent. of the payroll according to a private survey carried out. There is no settled definition of fringe benefits—or "social charges" as they are called in Europe—and practices differ from country to country. Generally, they include employment costs other than ordinary money wages, such as social-security contributions, paid holidays, vacations, sick leave, private pensions and similar items.

One type of benefit not found in the US—family allowances—weighs especially heavily on employers in France and Italy. France's system of maternity and family allowances requires business firms to pay as much as 14¼ per cent. of payroll into a Government fund. These allowances are paid out as wage supplements so that a worker with two children, for example, gets 22 per cent. more than his basic wage; a worker with three children gets 55 per cent. more. In Italy, the employer's contribution may run as high as 33 per cent. of the worker's wage. On the other hand, family allowances in the UK are paid out of general tax-revenues and business firms are spared from making direct contributions.

TABLE 1.—*Hourly Wages and "Fringe" Benefits in Manufacturing Industries, April, 1959.**

	Hourly wages.	Fringe benefits.	Total cost per hour.	Fringes as per cent of hourly wages.
Italy	0.35	0.26	0.61	74.0
Netherlands ..	0.44	0.13	0.57	30.1
France	0.47	0.24	0.71	51.5
West Germany ..	0.54	0.24	0.78	44.3
Belgium	0.56	0.17	0.73	31.0
Switzerland ..	0.67	0.10	0.77	15.4
United Kingdom ..	0.68	0.10	0.78	14.0
Sweden	0.94	0.14	1.08	15.3
United States ..	2.22	0.46	2.68	20.5

* Converted at official exchange rates into US dollars (currently running at about three dollars to £1 sterling.)

TABLE 2.—*Breakdown of Costs of "Fringe" Benefits in Manufacturing Industries in Eight European Countries and the United States, April, 1959. (Per Cent. of Hourly Wages.)*‡

	Italy.	France.	West Germany.	Belgium.	Nether-lands.	United States.	Switzer-land.	Sweden.	United Kingdom.
Legally-required social insurance ..	20.7	10.6	12.0	8.2	6.6	4.0	2.1	1.1	3.2
Private pensions, insurance, etc. ..	*	1.5	6.5	*	3.0	6.8	2.7	0.6	1.0
Work accident insurance	3.2	2.1	3.3	3.1	1.8	1.0	2.0	1.7	0.3
Family allowances	20.5	16.2	2.0	8.2	4.9	—	1.6	—	—
Paid vacations, holidays, etc. ..	11.5	10.6	9.5	10.5	9.6	7.1	6.0	6.3	7.0
Bonuses	9.5	1.5	4.0	0.2	4.2	1.7	—	—	0.5
Social services	7.4	2.7	} 7.0 { 0.8	†	†	1.0	3.5	2.0
Lodging	1.2	1.1	—	—	—	—	2.1	—
Special wage tax	—	5.2	—	—	—	—	—	—
Total	74.0	51.5	44.3	31.0	30.1	20.5	15.4	15.3	14.0

* Practically negligible. † Could not be estimated. ‡ Sources: French National Institute of Statistics and Economic Studies: United States recalculated to include 1959 survey data of the US Chamber of Commerce.

STANDARD TELEPHONES & CABLES, LIMITED, and Submarine Cables, Limited, of Britain, have been given contracts to supply 8,700 nautical miles of cable and 335 undersea amplifiers. The orders are worth over £A22,000,000, and the material is for the trans-pacific telephone cable project linking Australia, New Zealand and Canada. The new cable service will have 10 times the capacity of the present radiotelephone service, will maintain 80 telephone channels 24 hrs. a day and also provide telegraph, phototelegraph and telex circuits. Mr. Housley, convener of the Pacific Cable Management Committee, said that under the terms of the contract as much raw material as possible would be supplied by Australia and Canada. The cable project will be the biggest of its type yet undertaken and cost over £A33,000,000.

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Machine Tool Industry Research Association

The first director of the Machine Tool Industry Research Association will be 42-year-old Mr. Albert De Barr, B.SC., F.INST.P., who is at present head of the spinning department at the Shirley Institute, the British Cotton Industry Research Association's laboratory at Manchester. He will take up full-time duties on April 1.

Speaking from Manchester recently, Mr. De Barr said he thought that in the initial period his staff would be small. "Most of the work will be done by contract in other laboratories," he added, "because we don't initially intend to set up our own research laboratories." Membership application forms are being sent to the 100 or so firms who gave the Machine Tool Trades Association signed undertakings to support the research project for a minimum of five years. The MTIRA says that there is every reason for hoping it will be given full recognition by the Department of Scientific and Industrial Research "especially in relation to financial support."

"Exceptionally Good Export Record"

Mr. Anthony Barber, M.P. for Doncaster, and Economic Secretary to the Treasury, visited last month the Beilby works of Peglers, Limited, brassfounders, Doncaster, to learn, as he said, the "reasons for their exceptionally good export record"; also to hear if they were having any difficulties. The firm's export sales are five times as great as before the war, and they have maintained their exports at about £500,000 a year for the past 10 years. They hope to increase this figure in the near future. Water taps and plumbing fixtures made by the company go to nearly 50 countries.

Steel-processing Plant for Hadfields

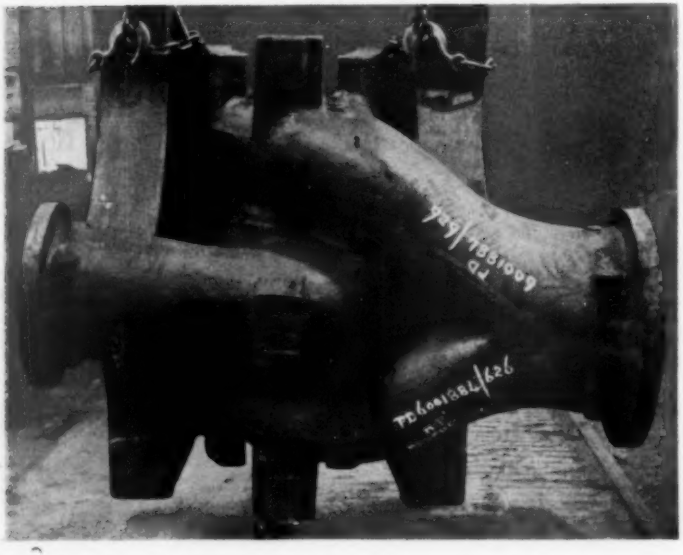
Hadfields, Limited, steel manufacturers, is to instal a large-scale unit for producing vacuum-melted ingots ranging from two to nine tons at its East Hecla Works, Sheffield. The decision follows two years of trials by Hadfields' research and development departments to assess the benefits of processing high-quality steels in consumable electrode furnaces. Many tons of steels have been treated and forgings made, which have demonstrated that improved quality can be consistently achieved.

The new unit, which is expected to be operating in September, will, it is believed, be the largest furnace of its kind operating in Europe. Equipment is being supplied by Stein & Atkinson, Limited, to the design of its associated company, the Lectromelt Furnace Division of the American McGraw-Edison Company. It will be housed in a new building, work on which has already begun.

British Standards Institute

Requirements for nine recommended alloys—which are considered to cover the range of properties generally needed in white-metal bearing alloys—are laid down in a new British Standard BS 3332:1961. While it is recognized that elements such as cadmium, nickel, silver, tellurium or arsenic are sometimes added to these alloys, these variants have not been included in the standard because, while for particular applications improved properties are claimed, some of the resulting alloys are more difficult to use. Copies of the standard may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1; price 5s. plus postage.

Success with an Awkward Casting

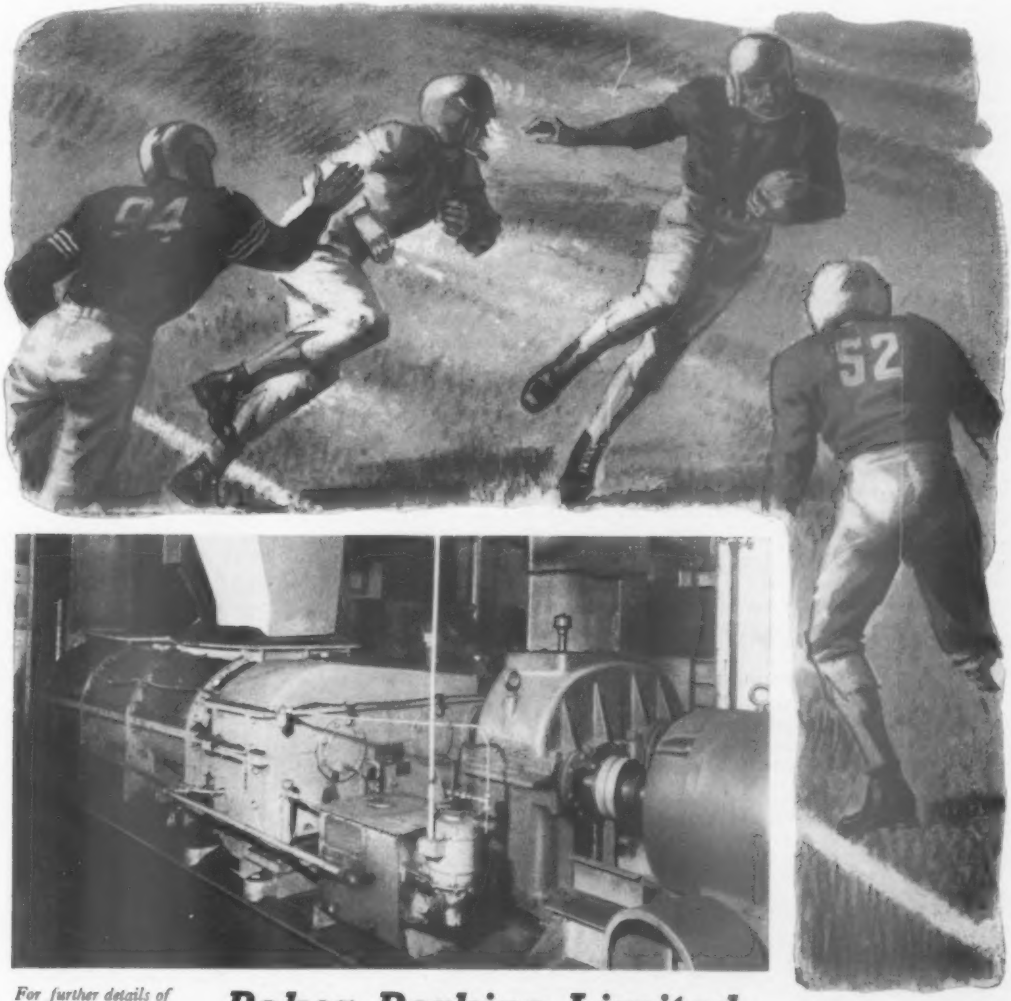


The illustration shows a steel casting weighing about three tons of extremely complex design and coring which is being produced successfully in the Sheffield foundry of Wm. Jessop & Sons, Limited. It is a bottom-half pump casing for Mather & Platt, Limited, the overall size being about 10 by 7 ft. Several of these items are required for booster-pump units of the single-impeller type for oil-field applications. The section thickness is 1¼ in., and the casting made in about 0.5 molybedenum and 0.3 per cent. carbon steel, has to withstand a test pressure of 3,000 lb. per sq. in. It is interesting to record that to prevent metal penetration and give a clean strip, zircon sand formulations were used at important locations in the manufacture of both moulds and cores. The British firm are to be congratulated on securing repeat orders for this casting after those made by certain Continental firms failed under test.

BAKER PERKINS FOUNDRY TEAM

-proved unbeatable in U.S.A.

The photograph below shows one of eight matched Baker Perkins units chosen to provide all the mixing requirements for an automotive grey iron foundry in the U.S.A. A strong line of five B-P (150 tons per hour) 5A Continuous Moulding Sand Mullers delivers consistently uniform sand into the moulding shop.
Behind them a B-P Core Paste Mixer and a B-P Core Wash Mixer ensure excellent core surfaces. Centre of the team is the B-P Refractory Clay Mixer for lining ladles and cupolas.
After four years of gruelling operation this B-P equipment has proved itself in all respects. It is built to do a rugged job consistently and with minimum maintenance.



For further details of this and other foundry machinery write to:

Baker Perkins Limited, *Engineers*

BEDEWELL DIVISION, HEBBURN-ON-TYNE, Co. DURHAM.

Tel. Jarrow 897124

BPF9

Raw Material Markets

Iron and Steel

Overall output of castings at the iron foundries continues below capacity level, and most establishments have room for more work. High quality castings for many trades are in heaviest demand, and the engineering and speciality foundries producing these are fairly well occupied, although output is at a reduced level due to the car industry recession. There has been little fall in the usage of castings required for motor vehicles and tractors, and this section has maintained a consistent demand. Fluctuating demand, however, is being made from car factories, and many foundries catering for them are still on short time.

Demand for light castings shows no appreciable change, although seasonal influences have resulted in slightly improved request by the domestic utensil trade. The requirements of the building trades are maintained at fairly good levels. More work, however, is needed by the light foundries, as capacity is nowhere near fully engaged. The jobbing foundries, together with the textile foundries, are also in need of more work.

Foundries are able to acquire all their supplies of pig-iron without difficulty. There is still a substantial demand for the low phosphoric irons from the engineering foundries, which are also absorbing regular quantities of hematite and, to a lesser extent, refined irons. High phosphoric irons are also in good supply for the light, jobbing, textile and some of the engineering foundries. Overseas buyers continue to purchase consignments, but additional quantities could be made available for this source if orders could be secured. Supplies of scrap continue short, and the foundries have difficulty in obtaining the required tonnages, particularly in the better and heavier grades of both cast iron and steel scrap. Foundry coke deliveries are satisfactory and ganister, limestone, and firebricks are available to requirement.

The re-rollers continue to obtain good outputs of small bars and light sections, and production of reinforcing rods is maintained at high levels. Apart from the latter section, demand shows a reduction on previous requirements, and for hot rolled strip and bright steel bars business is now on a much reduced scale. The re-rollers are well provided with mild steel semis, and quantities now available at home steelworks are in excess of demand. Output of carbons and alloy steel semis is not so plentiful.

Non-ferrous Metals

From many points of view, copper is an interesting market. The overall statistical position is not good, but this is wholly accounted for by the weakness in demand in the United States. In London, the price shows strong resistance to sinking below £220 a ton and the market is prepared to take advantage of anything which is even remotely bullish, tending to regard with an indifferent eye those factors which may redound adversely on the copper quotation.

Last week the current political discussions in London with the African leaders in Rhodesia were reported as reasonably satisfactory and the LME quotation firmed up immediately. Now, however, deadlock or an unsatisfactory compromise look like being the outcome of the talks and this tends to be ignored. The basis of this reasoning could be that if there is trouble in the Rhodesias it would be good for the copper price but bad for the individual copperbelt companies.

In any event, it was encouraging to see that the release of the December quarterly report from one of the major Rhodesian copperbelt companies showed that its previous avowal to cut back production had been carried out. This made for a firm market which then went ahead on the news from Chile that El Teniente had experienced a strike of the workers in the ore crushing section which caused mine operations to cease. For all these reasons the outlook is still not clear and no price trend is yet apparent.

In the US, the market is better rather than worse, although this does not say a great deal. The point of the US market is that sentiment has improved immeasurably on hopes that the new Kennedy administration will pull the economy out of its depression. Meanwhile, the price of 29 cents a pound is still applicable to both custom smelters and producers.

Tin in London is firm but uninteresting, the statistical outlook being the sustaining feature rather than actual demand conditions. Nevertheless, demand can be called satisfactory from both the UK and from the Continent. The Singapore market has shown improvement while the US market is holding its own with the price fluctuating narrowly around 100½ cents a pound.

Lead is quietly steady in London with the price edging upwards as a reflected improvement in the price of zinc. In the US the market remains quiet and the price unchanged at 11 cents a pound.

Zinc in London is now well clear of the £80 a ton level. The main factors in the improvement have been the cut back in production announced by a US major producer and the belief that the Lead-Zinc Study Meeting to be held in Mexico next month will recommend reductions in output. Meanwhile, it is hoped that other major producers will follow suit and restrict production. The US price for East St. Louis spot is unaltered at 11½ cents a pound.

Obituary

Mr. A. H. FROST, a director of Pickersgill & Frost, Limited, Star Foundry, Langley Mill, Notts, died in Heanor Memorial Hospital, on January 30.

The death has occurred, at the age of 88, of Mr. R. W. GOODINGS, who had been officer in charge of the ambulance room at J. Parkinson & Son (Shipley), Limited, machine-tool makers, Canal Ironworks, Shipley, since September, 1939.

Mr. PEARSON HARRISON, a former Alderman of Darlington Town Council, who died in January at the age of 94, was a steel moulder at the Darlington Forge, Limited, from 1890 until his retirement. He helped to found the Darlington Trades Council and was a member of Darlington Town Council from 1921 to 1946.

Mr. W. A. KAY, late of the physics department of Manchester University, died last month at the age of 81. For his research work with Lord Rutherford, on splitting the atom, he was made an honorary M.SC. of the University in 1946. The University service staff centre was named after him as "William Kay House."

City and Guilds Lecture Notes

A sub-committee of the IBF Education Committee, under the chairmanship of Mr. J. Hill, has prepared revised lecture notes for teachers in foundry practice to cover the ordinary grade examination of the City and Guilds of London Institute. Copies of these revised notes are now available to *bona fide* teachers of the subject without charge on application to the secretary of the Institute of British Foundrymen, 14, Pall Mall, London, S.W.1. Similar lecture notes are in preparation for the advance grade examination and for the ordinary and advanced grades of the patternmaking examination. It is hoped these will be available in about 18 months time.

LSR 81 Grinder at work on a heavy casting

COMPRESSED AIR for the FOUNDRY

Atlas Copco puts compressed air to work for industries of every class—light, medium and heavy. For foundry work there are Atlas Copco rammers, chipping hammers and grinders carefully balanced to reduce operator fatigue and ensure the best possible results. For example, rammers are designed to "walk" with a minimum of guidance, allowing the operators to give all their attention to tamping.

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Atlas Copco heavy duty grinders are easier, less tiring to use. They combine maximum power with minimum size and weight and are designed for the quietest possible operation. Special safety governors ensure constant speeds regardless of varying loads. These grinders open the way to increased output; with Atlas Copco R-type chipping hammers they form a range of robust, reliable tools for all types of fettling and dressing operations.

Air hoists—accurate to a fraction !

For ultra-sensitive control, Atlas Copco air hoists are in a class of their own. Their infinitely variable speeds permit loads to be placed with ease and accuracy. The air motors are fully protected and the hoist can be operated with complete safety in any atmosphere—hot, dusty, damp, explosive or corrosive.

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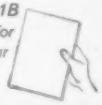
With companies or agents in ninety countries, Atlas Copco is the largest organisation in the world specialising solely in compressed air equipment. Products include stationary compressors from (2.5 to 20,000 c.f.m.) ·08 to 566m³/m portable compressors, air tools, rock drills, loaders and paint-spraying equipment. Wherever you are, the international Atlas Copco group offers expert advice and provides a complete after-sales service.

WRITE FOR CATALOGUE E811B

This catalogue presents a selection of Atlas Copco Equipment for industry (including the foundry trade). Write for a copy to your local Atlas Copco company or agent or to the address below.



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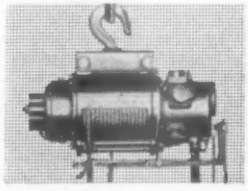
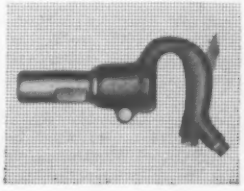
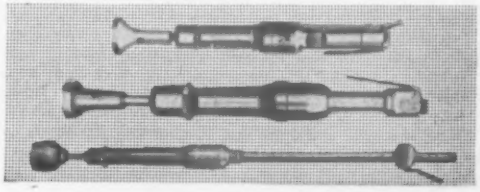


R3B Chipping Hammer



3 Rammers from the Atlas Copco range STR2



Current Prices of Iron, Steel, and Non-ferrous Metals

(Basis prices, delivered unless otherwise stated)

February 15, 1961

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2, 10-ton lots or over:- Middlesbrough, £21 17s. 0d.; Birmingham, £21 9s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.40 per cent. P 10-ton lots or over, £23 5s. 0d., delivered Birmingham £23 10s. 0d., delivered Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 6s. 6d.; South Zone, £25 9s. 0d.

Refined Malleable.—P, 0.10 per cent. max.; North Zone £26 6s. 6d.; South Zone, £26 9s. 0d.

Hematite.—Si less than 2 per cent, S. & P. over 0.03 to 0.05 per cent., 10-ton lots or over; N.-E. of England (local iron), £23 19s. 0d.; Scotland (Scotch iron), Zone S.1, £24 5s. 6d.; Sheffield, £25 9s. 0d.; Birmingham, £25 13s. 0d.; Wales (Welsh iron), £23 19s. 0d.

Basic Pig-Iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leicestershire in 10-ton lots or over.

FERRO-ALLOYS

(per ton unless otherwise stated, delivered)

Ferro-Silicon (6-ton lots and over).—45 per cent. Si, £43 10s. 0d. to £46 0s. 0d., scale 15s. 0d. per unit, lumpy. 75 per cent. Si, £60 0s. 0d. to £63 10s. 0d., scale 15s. 0d. per unit, lumpy.

Ferro-vanadium.—50/60 per cent., 22s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 10d per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 10s. 7d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 13s. 7d. per lb. of W.

Ferro-chrome (6-ton lots and over, lumpy).—4/6 per cent. C, £81 10s. 0d. to £84 10s. 0d., basis 60 per cent. Cr scale 27s. 0d. to 28s. 6d. per unit; over 6 per cent. C, £79 0s. 0d. to £82 10s. 0d., basis 60 per cent. Cr, scale, 27s. 0d. to 28s. 6d. per unit; 2 per cent. C,* 1s. 8d. to 1s. 11d. per lb. Cr; 1 per cent. C,* 1s. 8d. to 1s. 11½d. per lb. Cr; 0.15 per cent. C,* 1s. 9½d. to 2s. 0½d. per lb. Cr; 0.10 per cent. C,* 1s. 9½d. to 2s. 0½d. per lb. Cr; 0.06 per cent. C,* 1s. 11d. to 2s. 1d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 10d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free, £275 0s. 0d.; 96/98 per cent., £285 0s. 0d.

Ferro-columbium.—65/67 per cent., Cb + Ta, 19s. 9d. per lb., Cb + Ta.

Ferro-manganese (Standard).—78 per cent., £61 10s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft u.t., 100 tons & over, £31 15s. 6d.; tested, 0.08 to 0.33 per cent. C, 100 tons & over, £32 5s. 6d.; hard (0.41 to 0.60 per cent. C), 50 tons and over, £33 17s. 0d.; silico-manganese, 50 tons and over, £42 16s. 6d.; free-cutting, 50 tons and over, £35 4s. 6d. SIEMENS MARTIN ACID (50 tons and over): Up to 0.25 per cent. C, £40 11s. 0d.; silico-manganese, £43 4s. 0d.

Billets, Blooms, and Slabs for Forging and for Stamping (50 tons and over).—BASIC: Soft, up to 0.33 per cent. C, £37 0s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £38 2s. 6d.; acid, up to 0.25 per cent. C, £41 14s. 0d.

*Average 68-70 per cent.

FINISHED STEEL

Heavy Plates and Sections (50 tons and over).—Ship plate (N.-E. Coast), £40 7s. 0d.; boiler plates (N.-E. Coast), £42 17s. 0d.; floor plates (N.-E. Coast), £41 16s. 0d.; angles (N.-E. Coast), £38 1s. 6d.; joists (N.-E. Coast), £37 17s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats 5 in. wide and under, untested soft basic, 50 tons and over, £39 1s. 0d.; under 10 tons to 4 tons, £40 18s. 6d.; under 4 tons to 2 tons, £41 3s. 6d.; hoop and strip, coils, 100 tons and over, £38 0s. 0d.; uncoated strip mill coils, hot rolled, under 3 mm. to 12g., 25 tons to under 50 tons, £43 16s. 0d.; black sheets (hand mill), 24g., 10 tons and over, £57 14s. 6d.; galvanized corrugated sheets, 24g., 10 tons and over, £67 11s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £66 7s. 0d.; nickel-chrome, £97 1s. 0d.; nickel-chrome-molybdenum, £109 14s. 0d., in lots of 25 tons and over.

NON-FERROUS METALS

Copper.—Cash, £224 0s. 0d. to £224 5s. 0d.; three months, £225 5s. 0d. to £225 10s. 0d.; settlement, £224 5s. 0d.

Copper, Tubes, etc.—Solid-drawn tubes, 2s. 1½d. per lb.; rods, 237s. 0d. per cwt. basis; 20 s.w.g., 272s. 0d. per cwt.

Tin.—Cash, £791 0s. 0d. to £791 10s. 0d.; three months, £794 10s. 0d. to £795 0s. 0d.; settlement, £791 10s. 0d.

Lead (Refined Pig).—First half February, £66 5s. 0d. to £66 10s. 0d.; first half May, £67 5s. 0d. to £67 10s. 0d.; settlement, £66 10s. 0d.

Zinc.—First half February, £83 15s. 0d. to £83 17s. 6d.; first half May, £83 0s. 0d. to £83 12s. 6d.; settlement £83 17s. 6d.

Zinc Sheets, etc.—Sheets, 15g., and thicker, all English destinations, £122 0s. 0d.; rolled zinc (boiler plates), all English destinations, £120 5s. 0d.; zinc oxide (Red Seal) d/d buyers' premises, £95 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 9d. per lb.; sheets to 10 w.g., 194s. 0d. per cwt.; wire, 2s. 7½d.; rolled metal, 194s. 0d. per cwt.

Brass (Brazing).—BS1400, B3, £174; B6, £221.

Brass (High Tensile).—BS1400, HTB1, £193; HTB2 £210; HTB3, £229.

Gunmetal.—BS1400, LG2, £217; LG3, £227; G1, ⅛% £290; G1, 1%, £280.

Phosphor Bronze.—BS1400, PB1 (AID released), £306; BS1400, 90/10/1, £294.

Leaded Phosphor Bronze.—BS1400, LPB1, £238.

Phosphor Bronze Strip, etc.—Strip, 277s. 9d. per cwt.; wire, 4s. 0¾d. per lb.; rods, 3s. 3d.; tubes, 3s. 3d.; chill cast bars, solids 3s. 2¾d.; cored 3s. 3¾d. (CHARLES CLIFFORD LIMITED).

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 9¾d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 2¾d.; special quality turning rod, 10 per cent., ¼ in. dia., in straight lengths, 4s. 1¾d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 2¼d. to 2s. 3d. per lb.; Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £69 0s. 0d. Nickel, £600 0s. 0d. Aluminium, ingots, £186 0s. 0d.; aluminium bronze (BS1400), AB1, £243; AB2, £251.

New Patents

(Copies of complete specifications are obtainable from the Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d.)

831,161. S. Smith and Sons (England), Limited, Cricklewood Works, London, N.W.2.

Cast balance wheels for time-pieces, formed so that there is placed integrally, an anchor post for a spring.

831,162. British Petroleum Company, Limited, Britannia House, Finsbury Circus, London, EC.2.

A process for producing a separating agent for foundry moulds, and cores, especially those in mould facing or hollow-cored form. A refined mineral-oil fraction, which burns without leaving a residue, is converted into a stable water-in-oil emulsion, and an aqueous solution of inorganic salts is incorporated into this emulsion. The composition thus obtained consists of water, 51.5; oil fraction, 40; sodium chloride, 4; ammonium sulphate, 2; aluminium sulphate, 2; and non-ionic emulsifier, 0.5 per cent. by weight.

831,167. Foundry Services, Limited, Long Acre, Nechells, Birmingham, 7.

Truncated rectangular pyramid-shaped head-boxes for use in making ingots. Each corner of the pyramid is slotted completely through the wall of the box and part way down from the mouth of the box, so that the distance between the bottoms of diagonally opposed slots is slightly greater than the base length of the trapezium slabs which are to be fitted into the box.

831,174. General Motors Corporation, Grand Boulevard, Detroit, Michigan, USA.

Production of thin-walled foundry moulds for metal casting which are similar to shell moulds. By the invention it is claimed that moulds may be made quickly and cheaply.

831,228. J. S. Hoekstra, Van 't Haaffstraat 30, Noordwijkerhout, Holland, and H. J. M. Verschure, Cliostraat, 46 (II), Amsterdam, Holland.

A device for the manufacture of shells for shell-moulding processes.

831,494. Wellman Smith Owen Engineering Corporation, Limited., Parnell House, 25, Wilton Road, London, S.W.1.

The continuous casting of metal tubes and other tubular-metal objects.

831,528. Fonderite S.A.R.L., 31 Clemenceau Av., Corneilles en Parisis, (Seine et Oise), France.

A new or improved process for casting steel ingots free of shrinkage cracks or flaws and shrinkage holes or funnels—without the use of dead heads.

831,781. J. Cervasek, 7 Korenskeho, Praha, 16, and V. Otahal, 8 Postovska, Brno, Czechoslovakia.

Process for the manufacture of ductile cast iron. Elementary magnesium is dissolved in molten cast iron in a pressure vessel the atmosphere of which is raised above atmospheric pressure before the addition.

831,819. S. and R. J. Everett and Company, Limited, 939, London Road, Thornton Heath, Surrey.

Die-casting of mounts on hypodermic needles.

831,858. United States Steel Corporation, 525, Wm. Penn Place, Pittsburgh, 30, Penna., USA.

An improved method for the introduction of oxygen into the molten bath in the open-hearth steelmaking process.

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Personal

Jones Sewing Machine Company, Limited, Guide Bridge, Audenshaw, near Manchester, announce that Mr. R. D. DURRANT, has been appointed sales manager.

Mr. ARTHUR ROBINSON, machine-shop foreman of G. C. Ogle & Sons, Limited, agricultural engineers of Ripley, Derbyshire, has retired after 59 years' service with the firm.

Mr. W. L. WATSON, works manager of the Northampton works of Pollard Bearings, Limited, has been appointed to a similar post at the Ferrybridge (Yorkshire) works.

Mr. KENNETH H. PLATT, M.B.E., B.SC., M.I.MECH.E., has been appointed secretary of the Institution of Mechanical Engineers as from May 31. He replaces Mr. BRIAN G. ROBENS who is retiring.

Mr. ANDREW RANKINE, who recently retired as city architect to the Hull Corporation, has joined J. H. Fenner & Company, Limited, as building and architectural adviser to the group.

Mr. ALAN THRELFALL has been appointed sales manager to Perkins Gas Turbines, Limited. Before joining the Perkins group he was a senior sales engineer with Lucas Industrial Equipment, Limited.

Silbond Refractory Manufacturing Company, 29, Crofton Avenue, Sheffield, 6, announce the appointment as works manager of Mr. L. J. A. HAYWOOD, formerly chief chemist to Catton & Company, Limited, of Leeds.

Mr. H. A. S. MOULE, formerly sales manager of Glow Worm Boilers, Limited, and an executive director of Sunrod Domestic Boilers, Limited, has been appointed a director of International Boilers & Radiators, Limited.

Mr. JAMES RITCHIE has been appointed financial director of Holman Brothers, Limited, Camborne, Cornwall. Mr. J. L. RITCHIE, sales director, and Mr. J. M. WILLIAMS, London director, have been appointed to the board.

Coun. JAMES NORTON WELCH, aged 44, area manager for Keighley Lifts, Limited, Vulcan Works, Dalton Lane, Keighley, has accepted the invitation of the Council's Mayoral Selection Committee, to be Keighley's next Mayor.

On February 3, the directors of Catton & Company, Limited, a subsidiary of Weir-Catton, Limited, invited over 50 employees with over 25 years' service to a special function to celebrate the completion of 50 years' service by pattern storekeeper, Mr. ALFRED STRICKLAND.

Mr. FREDERICK A. LESSER (deputy chairman and managing director of Borax (Holdings), Limited) has been appointed to the board of Hardman & Holden, Limited. The appointment follows the recent acquisition of Hardman & Holden by the Borax group.

Mr. E. F. COPPOCK has been appointed group financial controller to Metal Industries, Limited. He succeeds Mr. P. JARDINE who is taking up full-time directorships with J. G. Statter & Company, Limited, and Minerva Mouldings, Limited, two MI subsidiaries.

Mr. R. M. I. HOBILL, 54, has been appointed a director of Ferranti, Limited. In 1946, he was appointed sales manager, London area, and in 1951 became sales manager of the transformer department at Hollinwood, and was appointed manager of that department in 1958.

His Royal Highness, the DUKE OF EDINBURGH, is to deliver the Graham Clark lecture on "Resources, Human and Natural, of the Commonwealth," at the Institution of Civil Engineers on April 13 at 5.30 p.m. It is a joint meeting of three senior engineering institutions.

Mr. G. ARNOLD HART, president and chief executive officer of the Bank of Montreal, has been elected a director of the International Nickel Company of Canada, Limited. He fills the vacancy on the board caused by the recent death of Mr. EDWIN G. BAKER, chairman of the Canada Life Assurance Company.

Mr. JOHN SMITH has joined the board of Ultrasonics, Limited, Otley, with special responsibilities in the mechanical division. He joined the company in 1954. Mr. B. H. FORDHAM, the company's chief engineer since May, 1958, has also joined the board. Ultrasonics, Limited, is a subsidiary of Croda Organisations, Limited.

Mr. ROLAND A. KIRKBY, chairman of General Refractories, Limited, Sheffield, has been appointed by King Baudouin an Officer of the Order of the Crown of Belgium. Mr. Kirkby has had business connections with Belgium since 1931, and for many years has been president of General Refractories' subsidiary company at Seilles-Andenne.

Professor G. G. HASELDEN, the recently-appointed Brotherton Professor and head of the department of chemical engineering at the University of Leeds, gave his inaugural lecture on February 6. Professor Haselden, whose speciality is the use of very low temperatures in industry, spoke on "Chemical Engineering and its Educational Challenge."

In recognition of their services to the Institute of British Foundrymen over many years, Mr. S. H. RUSSELL, O.B.E., C.G.I.A., and Mr. J. J. SHEEHAN, B.SC., A.R.C.S.C.I., have been made honorary members of the Institute—the highest honour the Institute can bestow. Their certificates will be presented to them at the annual general meeting at Cheltenham on May 16.

Mr. M. A. KENYON has been appointed area sales engineer (with effect from February 1) of the first branch office in the UK of Foundry Equipment, Limited, Leighton Buzzard. The office will cover the whole of Lancashire, Cheshire, and East and West Ridings of Yorkshire; the address is Hartford House, 126, Broad Street, Salford, 6, Manchester (telephone: Pendleton 5271).

Mr. JAMES ANDERSON, chairman and managing director of Anderson Boyes & Company, Limited, mining-machinery manufacturers, Motherwell, and president of the Scottish Engineering Employers' Association, has been appointed chairman of an organizing committee set up by the Industrial Training Council to convene a Scottish conference on industrial training. The conference will be held in Glasgow in March.

Mr. C. WALTERS, commercial local director, Markham & Company, Limited, engineers of Chesterfield, has been appointed a director of the firm. He was formerly with the Butterley Company, Limited, and had held positions of chief draughtsman, chief engineer, manager of the constructional engineering departments, and for some time was manager of the firm's London office. He joined the Markham company in 1946.

Mr. ERIC TURNER has joined the board of the Churchill Machine Tool Company, Limited, and has been appointed chairman. Mr. S. A. ROBERTS has been appointed to the board and Mr. E. W. HUNNISETTE continues as managing director. Sir GREVILLE S. MAGINNESS, Mr. PAUL CHAMBERLAIN and Mr. HAROLD E. CHURCHILL have retired from the board. These changes follow the take-over of the company by the Birmingham Small Arms Company, Limited.

Translation Service

From amongst the most recently published lists of translations available from the Iron & Steel Institute (4, Grosvenor Gardens, London, S.W.1), the following have been selected as being of interest to founders. The price quoted is that for single copies, postage extra, there being reductions for quantities ordered. Readers writing for translations, or for further information, should mention this JOURNAL when doing so.

BISI 1718 POSSIBILITIES FOR AUTOMATION IN THE IRON AND STEEL INDUSTRY OFFERED BY ELECTRONICS. Plettner, B. *Stahl u. Eisen*, 1960, Apr. 14, pp. 508-513. (£4). The possibilities offered by the employment of analogue-digital analysers towards automation on a broad basis in iron and steel works are discussed. Programming as a further means in this direction is also mentioned. (*JISI* abstract.)

BISI 1765 PERFORMANCE OF AN IMPROVED "KAROL"-TYPE HAMMER MILL. (From Polish.) Szwejda, F. *Koks-Smola-Gaz* (Poland), 1958, *3*, (1), pp. 25-27. (£1.)

BISI 1827 RADIOACTIVE MARKING TECHNIQUE FOR INVESTIGATING METALLURGICAL PROCESSES IN STEELWORKS. (From German.) Probstl, G. H. *Stahl Eisen*, 1960, *80*, June 23, 863-877. (£9 5s.) A lecture delivered to the Verein Deutscher Eisenhüttenleute dealing with the whole field of application of radioisotopes in steelworks. This review is well illustrated and supplemented by 119 references and followed by a discussion. (*JISI* abstract.)

BISI 1842 MOULDED STRUCTURAL STEEL FOR PRESSURE-CASTING TOOLS AND MOULDS. (From German.) Hiller, H. *Giesserei*, 1957, Mar. 14, pp. 141-149. (£5 10s.)

BISI 1853 NON-DESTRUCTIVE QUALITY CONTROL OF CAST-IRON PARTS BY DETERMINATION OF ULTRASONIC DAMPING. (From German.) Bierwirth, G. *Giesserei*, 1960, Feb., pp. 94-98. (£3 5s.) Quality control in the iron foundry by ultrasonic attenuation measurements has proved successful, particularly if a large series of the same casting is involved. For each type of casting, frequency and testing programme has to be determined beforehand. It was found that the immersion technique gives best results. While a clear relation exists between strength and attenuation of cupola iron, it was absent for iron processed in the electric furnace, i.e. special precautions have to be applied in the ultrasonic testing of castings from electro-iron. (*JISI* abstract.)

BISI 1864 MECHANICAL DATA-RECORDING AS AN AID TO QUALITY CONTROL. (From Italian.) Casadio, M. Conference on Statistical Quality Control (Convegno sul controllo statistica della qualità), A.I.C.Q., Milan. 22-23 Oct., 1959. (£1 15s.)

BISI 2010 APPLICATION OF CHROMATOGRAPHY TO THE ANALYSIS OF GAS MIXTURES EXTRACTED FROM METALS BY VACUUM MELTING UNDER REDUCING CONDITIONS. (From French.) Baque, C., & L. Champeix. *Rev. Mét.*, 1960, *57*, Oct., 919-923. (£2 15s.)

Translations in course of preparation include:—

BISI 2017 NEW METHOD FOR THE ANALYSIS OF CARBIDES IN STEELS. (From Czech.) Lubomir, B., *et al. Hutnické Listy* (Prag), 1960. (9), pp. 679-686.

BISI 2020 PRODUCTION OF CHILLED ROLLS FROM SPHEROIDAL-GRAPHITE CAST IRON. (From Polish.) Rusiew, R. D. *Przeglad Odlewnictwa*.

BISI 2024 PRESENT POSITION OF THE LARGE-CAPACITY ARC-FURNACE IN IRON AND STEELMAKING. (From French.) Boutigny, R., & C. Barbazanges. *Rev. Mét.*, 1960, July, pp. 589-600.

BISI 2029 RAPID FLAME-PHOTOMETRIC METHOD FOR THE DETERMINATION OF Na_2O AND K_2O IN VARIOUS REFRACTORY MATERIALS. (From German.) Konopicky, K., & W. Schmidt. *Deut. Keram. Ges. Ber.*, 1960, Aug., pp. 368-371.

BISI 2030 NEW NON-DESTRUCTIVE ELECTRO-MAGNETIC TESTING PROCEDURE. (From German.) Havelka, F. *Wissenschaftliche Zeitschrift der Hochschule für Schwermaschinenbau Magdeburg*, 1959, (2/3), pp. 189-193.

BISI 2032 DESIGN OF A NEW ULTRASONIC PROBE FOR THE EXAMINATION OF CAST-IRON PIPES. (From German.) Wehr, J. *Wissenschaftliche Zeitschrift der Hochschule für Schwermaschinenbau Magdeburg*, 1959, (2/3), pp. 207-214.

BISI 2036 PROBLEMS OF OPERATING AND LINING OF LARGE ARC FURNACES. (From German.) Porkert, O. *Ibid.*, 1960, Nov. 24, pp. 1770-1775.

BISI 2037 REMOVAL OF BROWN SMOKE FROM THE BESSEMER CONVERTER WITH A WET ELECTRO-FILTER. (From German.) Guthman, W. *Ibid.*, 1960, Nov. 24, pp. 1803-1805.

BISI 2039 TEMPERATURE MEASUREMENT WITH NEW IMMERSION THERMOCOUPLE. (From German.) Meerkamp Van Embden, H. J. *Giesserei*, 1960, June 16, pp. 328-329.

BISI 2040 DEOXIDATION OF IRON BY MELTING UNDER VACUUM. (From French.) Turillon, P. *Rev. Mét. Mém. Sci.*, 1960, Sept., pp. 649-657.

BISI 2057 EVALUATION OF TEST-METHODS FOR NON-METALLIC INCLUSIONS IN Ck22 STEEL. (From German.) Eckstein, H.-J., & K. Schneider. *Ibid.*, 1960, *5*, Oct., 607-617.

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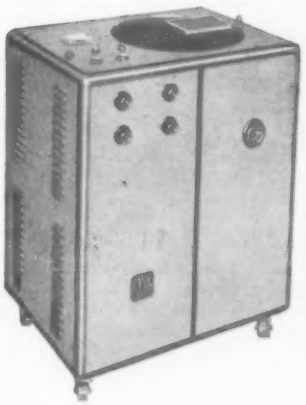

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SITUATIONS WANTED

SALES AGENT in London area offers services to foundries producing castings either in stainless steel and alloy or in grey iron. Remuneration by commission. Box SA608, FOUNDRY TRADE JOURNAL.

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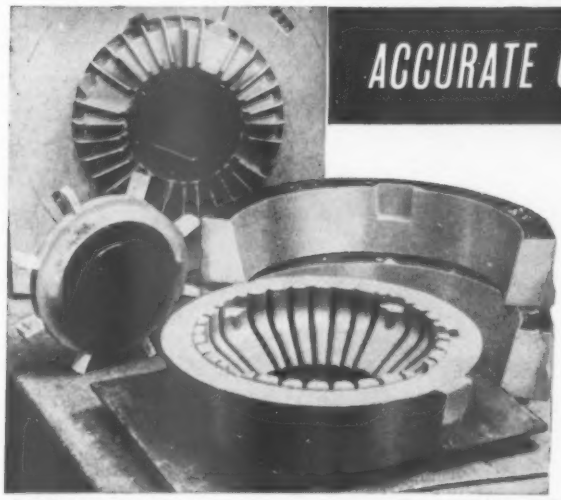

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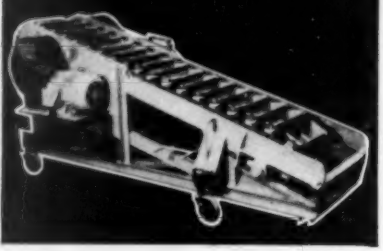

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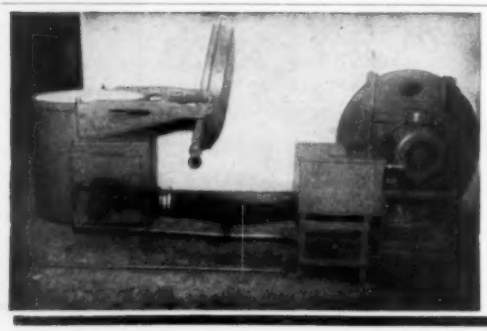

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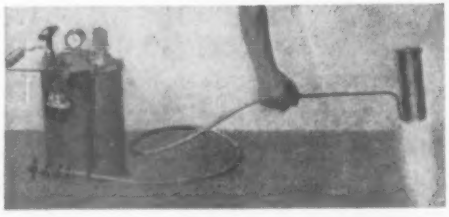

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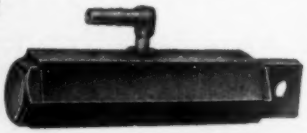

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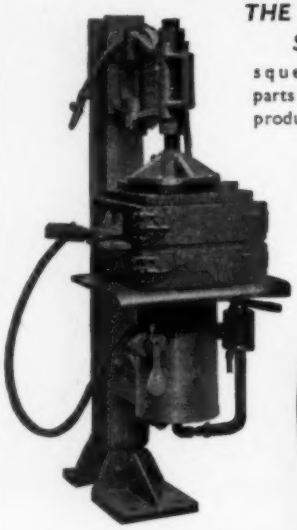

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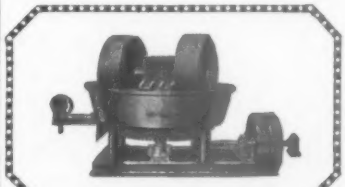

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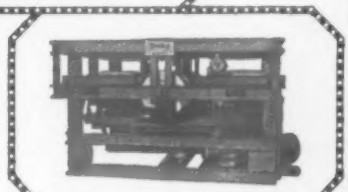

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Acme Conveyors, Ltd.	—
Air Control Installations Ltd.	54
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Atlas Copco (G.B.), Ltd.	223
August's, Ltd.	44
Austin, E., & Sons, Ltd.	52
Badische Maschinenfabrik A.-G.	12
Bairds & Scottish Steel, Ltd.	—
Baker Perkins, Ltd.	221
Balbardie, Ltd.	—
Ballard, F. J., & Co., Ltd.	—
Ballinger, L. J. H., Ltd.	—
Beck, H., & Son, Ltd.	—
Belliss & Morcom, Ltd.	—
Bennett, H. G., & Co. (Gloves), Ltd.	55
Berk, F. W., & Co., Ltd.	—
Bilston Shot & Grit Co., Ltd.	—
Bilston Stove & Steel Truck Co., Ltd.	—
Birkett, F. W., & Co., Ltd.	34
Birlec-Efco (Melting), Ltd.	60
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Boydell, E., & Co., Ltd.	—
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British Aero Components, Ltd.	—
British Electrical Repairs, Ltd.	—
British Foundry Units, Ltd.	30
British Industrial Sand Ltd.	2
British Iron & Steel Federation	—
British Monorail, Ltd.	—
British Moulding Machine, Co., Ltd.	36 & 37
British Oxygen Co., Ltd.	—
British Ronceray, Ltd.	4
British Shotblast & Engineering Co., Ltd.	57
Bromhead & Denison, Ltd.	—
Broom & Wade, Ltd.	25
Buckland Sand & Silica Co., Ltd.	—
Burn, John, & Co. (B'ham), Ltd.	—
Burnand, W. E., & Son, Ltd.	—
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Carborundum Co., Ltd.	—
Catalin, Ltd.	—
Cawood Wharton & Co., Ltd.	56
Centrozap Foundry Machines	—
Chapman & Smith, Ltd.	—
Chemicals & Feeds, Ltd.	—
Chetham Timber Co., Ltd.	—
Ciba (A.R.L.), Ltd.	—
City Casting & Metal Co. Ltd.	—
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Comley, A., Ltd.	—
Consolidated Pneumatic Tool Co., Ltd.	—
Constructional Engineering Co., Ltd., The	18
Controlled Heat & Air, Ltd.	—
Conveyor & Shotblast, Ltd.	—
Cooke, Bailey, Ltd.	50
Coreshooters Sales Ltd.	—
Cox & Danks, Ltd.	—
Crockett Lowe, Ltd.	26
Crooks, L. E.	—
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Dickson, Roy Wilson Ltd.	—
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Dowler, H. J., Engineers & Pattern Makers, Ltd.	50
Dowson & Mason, Ltd.	—
Dunford & Elliott, Ltd.	—
Durrans, James, & Sons, Ltd.	38
Dustraction Ltd.	57
Dustuctor Co., Ltd.	—
Dyson, J. & J., Ltd.	42
Electrical Development Assoc.	—
Electrogenerators, Ltd.	—
Elliott, E. & Co., Ltd.	—
Escol Products, Ltd.	—
Evans, James, & Co., Ltd.	56
Evans, Roy, M.I.B.F.	—
Evans, Stanley N., Ltd.	—
Eyre Smelting Co., Ltd.	34
F. & M. Supplies, Ltd.	219
Felco Hoists, Ltd.	—
Filter-Heat, Ltd.	—
Fischer, George, Ltd.	5
Fisher-Foundries, Ltd.	56
Fletcher Miller, Ltd.	53
Flextol Engineering Co. Ltd.	—
Fordath Engineering Co., Ltd.	14 & 15
Foseco International, Ltd.	—
Foundry Equipment, Ltd.	28 & 29
Foundry Mechanisations (Baillot), Ltd.	—
Foundry & Metallurgical Equipment Co., Ltd.	23
Foundry Plant & Machinery, Ltd.	7
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Fullers' Earth Union, Ltd. The	59
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Guyson Industrial Equipment Ltd.	—
Harborough Construction Co., Ltd.	13
Hargraves Bros. (Manchester), Ltd.	—
Harris & Pearson, Ltd.	—
Harvey & Longstaffe, Ltd.	—
Harvey, J. J. & Pressurecast, Ltd.	—
Hedin, Ltd.	—
Heneage Metals, Ltd.	—
Hepburn Conveyor Co., Ltd.	21
Heywood, S. H., & Co., Ltd.	—
High Speed Steel Alloys Ltd.	—
Hills (West Bromwich), Ltd.	—
Holman Bros., Ltd.	—
Holmes, W. C., & Co., Ltd.	10
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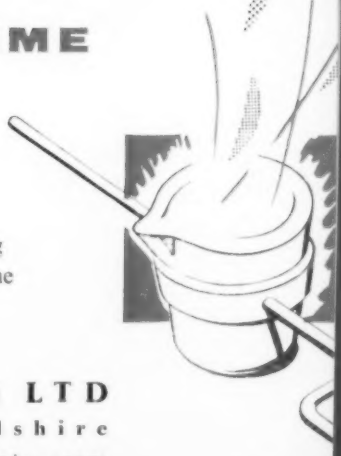

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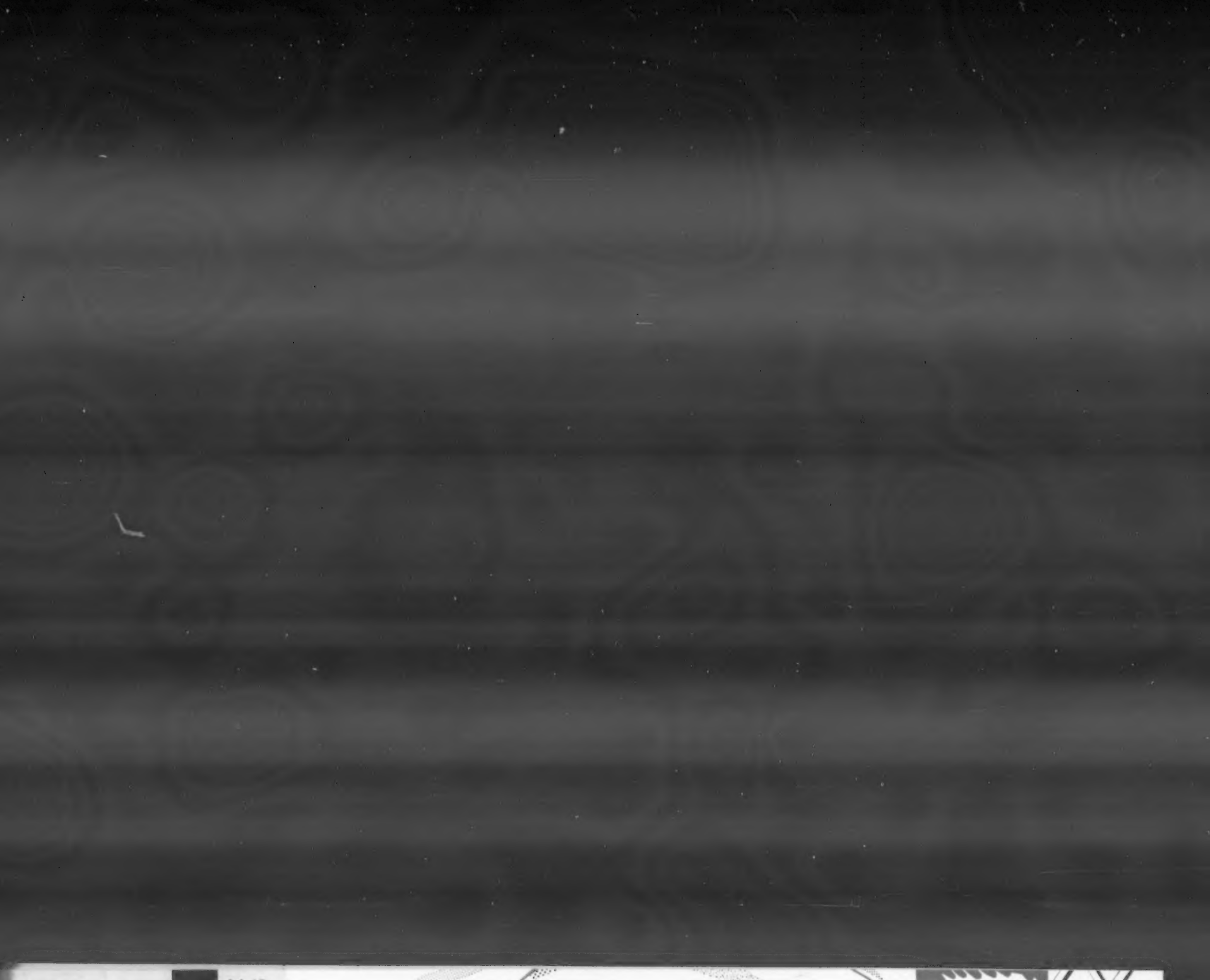
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